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MARY CYNTHIA DICKERSON, *Editor*

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Photograph by Herbert J. Spinden

A STRONGHOLD OF THE ANCIENT CLIFF DWELLERS

Looking up the cañon of the Rito de los Frijoles, New Mexico, from a ceremonial cave in the cliff. The streams flowing into the Rio Grande from the west have cut deep gorges through the yellow tufa. The cliffs on the north side of the stream are very steep, and in them are found artificial caves made by ancient peoples

THE AMERICAN MUSEUM JOURNAL

VOLUME XVII FEBRUARY, 1917 NUMBER 2

Excavation of the Aztec Ruin

By N. C. NELSON

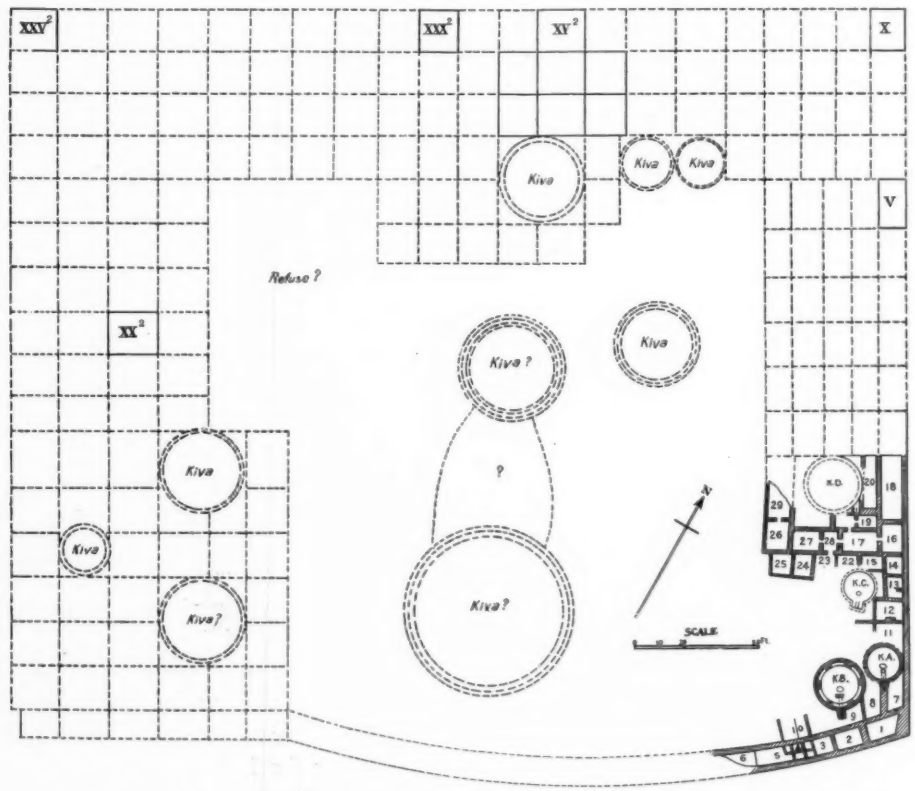
THE AMERICAN MUSEUM began last summer the complete excavation and reparation of one of the finest and best preserved examples of prehistoric Pueblo architecture in the Southwest. This ruin is located in the Animas Valley, in northwestern New Mexico, a few miles below the Colorado boundary and directly across the river from the town of Aztec. The town, it may be explained parenthetically, takes its name from the ruin which, according to erroneous but persisting popular notion, was built, not by the "Indians," but by members of the Aztec tribes whose habitat since before the Columbian discovery has been confined to Middle America. A resident of Aztec, Mr. H. D. Abrams, is the owner, and he has generously given the Museum a concession to clear out and investigate the entire ruin. It is the largest single piece of scientific work of the kind ever undertaken within the limits of the United States. The first season's excavation was provided for through the generous assistance of Mr. J. P. Morgan. Mr. Archer M. Huntington has generously contributed funds for the continuation and completion of the work.—THE AUTHOR.

THE Aztec ruin is the principal member of a large group of more or less ancient houses and villages localized within a short radius. If not the last of this group to be inhabited, it appears at any rate to embody the highest development of architectural ideas attained by the Pueblo Indians in that section of the Southwest. The site is of more than usual scientific importance, partly because of its relatively excellent state of preservation but more especially because of the fact that the owner has for many years guarded it against vandalism. Other ruins of the identical type exist for a hundred miles or so around, and although far less accessible than the Aztec pueblo, they have been for the most part systematically looted. The investigation of the ruin involves two things: first and foremost, the collection of every available particle of information that may serve to throw light on the habits and attainments of the builders; and second, the repair (not the restoration) of the standing portions of the structure, making it at once a monument to the Indian and an attraction to the more and more interested public.

The Aztec ruin represents what was at once a great house and a village. That is to say, it was something like a large modern American apartment house in size, but different from it in that its inhabitants constituted a closely organized community. The basic principle of this organic group was coöperation. How the Indian came to adopt this coöperative plan we cannot precisely tell. It may be that it grew out of economic necessity. Thus to insure good crops even in the beautiful Animas Valley he was obliged to resort to artificial watering, and nothing short

of coöperation in digging and maintaining irrigation ditches would have been practicable. Again, the Pueblos may have been hard pressed by encroaching nomads, and in that way compelled to group together for mutual protection and to build villages that were in reality great fortresses of no mean order.

An examination of the accompanying illustrations will perhaps give a better general idea of the essential nature of these fortresses than any amount of verbal description. The ground plan and the restoration are especially illuminating. Stated in the simplest terms, the Aztec pueblo consists of three buildings joined in such a way as to enclose three sides of a rectangular court. This court faces approximately south and is enclosed by a curving wall, which in this particular case has been expanded so as to accommodate a row of small rooms. The only entrance to the fortress, as far as we at present know, led through a door in this wall and was presumably closed and barred at night as well as in time of trouble. The guard, or at any rate the defenders, we may imagine to have mounted this wall



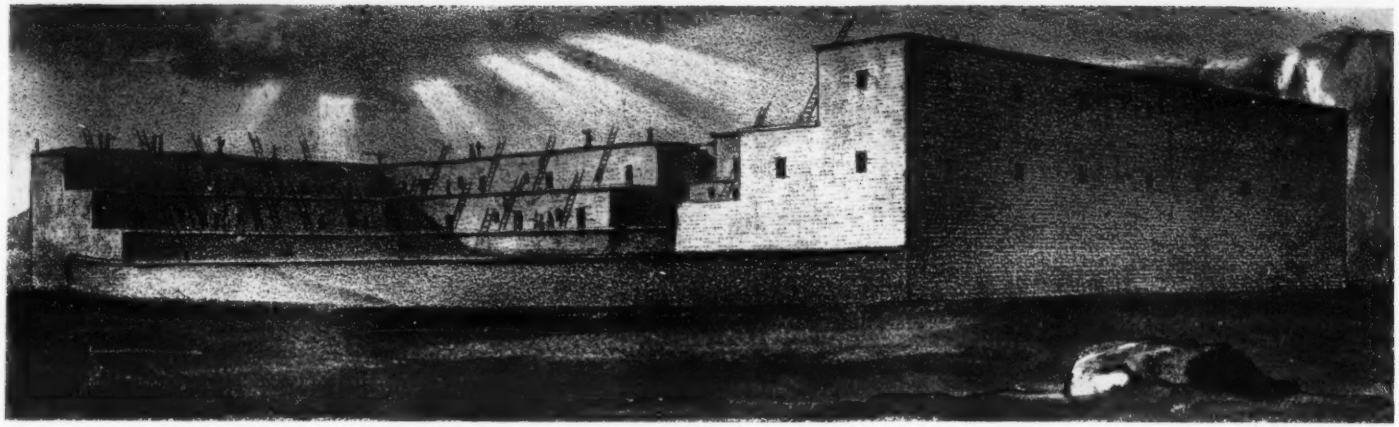
Ground plan of the Aztec ruin as apparent before excavations were begun in July, 1916. The numbered rooms with shaded or solid walls are those cleared by the Museum Expedition. It may be noted that the long walls of the west wing and the cross walls of the north wing join exactly, as if this portion of the village had been planned and built at the same time. The east wing, on the other hand, shows irregularities in that its long partition walls do not meet the cross walls of the north wing, and also in that this building does not appear to have been completed at the south end. This last peculiarity was probably due to the presence at this spot of an older house which was partially incorporated in the great pueblo

and to have fought from behind a parapet. At all events, the initial attack would have to be delivered against this wall, because it affords the only means of access to the village, the strong outer walls of the pueblo buildings proper being a sheer three or four stories high and provided with no apertures large enough to admit a man. Even if the enemy succeeded in reaching the court of the village, his victory was less than half assured, because there were no entrances leading directly from the court to the houses. As may be observed in the restoration, the three buildings on the sides facing the court rose by receding steps, each normally one story high and one room wide. These separate levels of rooms were reached not by interior stairways but by outside ladders which could always be drawn up, thus placing the attacking foe at a succession of disadvantages. Of particular importance was the fact that while each of the upper tiers of rooms was entered by a door through the front wall in the normal way, the ground floor rooms were entered only through trapdoors in the roof. The enemy, to get into the building at all (to set fire to it, let us say), was therefore obliged first to scale the lower story. To do this he would have to bring his own ladders and expose himself in a more or less weaponless condition. From these brief details it will be apparent that as a military contrivance this type of village could scarcely be improved upon.

One very interesting fact about this type of pueblo, is that the builders must have planned it out in full before beginning construction, because the village, once completed, was relatively difficult to modify or enlarge. This implies that the builders must have taken something like a census of the originally dispersed members of the community and have built on a scale to suit demands. Limited modifications and enlargements could be made, however, and are indicated perhaps in the Aztec pueblo by the addition of a series of rooms on the court side of the west wing. There is also the suggestion of a building projecting into the court from the center of the main wing. This center wing is very unevenly developed in observed ruins of the type, and may, therefore, be a deliberately chosen method of accommodating an increasing population.

The Aztec ruin lies on the smooth but gently sloping valley floor, perhaps five hundred yards from the right bank of the Animas River and about two hundred yards from the base of the barren gravelly uplands. Within a stone's throw there are no fewer than eight additional ruins (one, at least, being apparently incorporated in the pueblo), and within a mile or less there might at one time have been counted certainly all of one hundred ruins, some situated in the valley and some on the terraces above. The greater number of these ruins are of small or medium size, representing houses of both angular and curvilineal ground plans, and built, as a rule, of easily procured cobblestones or river bowlders, laid in mud. Some are built entirely of mud or adobe. Occasional ruins, however, were constructed more or less completely of dressed sandstone blocks, as is the main pueblo itself. In other words, we have here, probably, the remains of a long-lived community, the members of which at first lived in scattered houses but gradually united into larger and larger groups until finally, perhaps, they were all gathered within the walls of the fortress-like pueblo.

The great Aztec pueblo contained about five hundred rooms and may

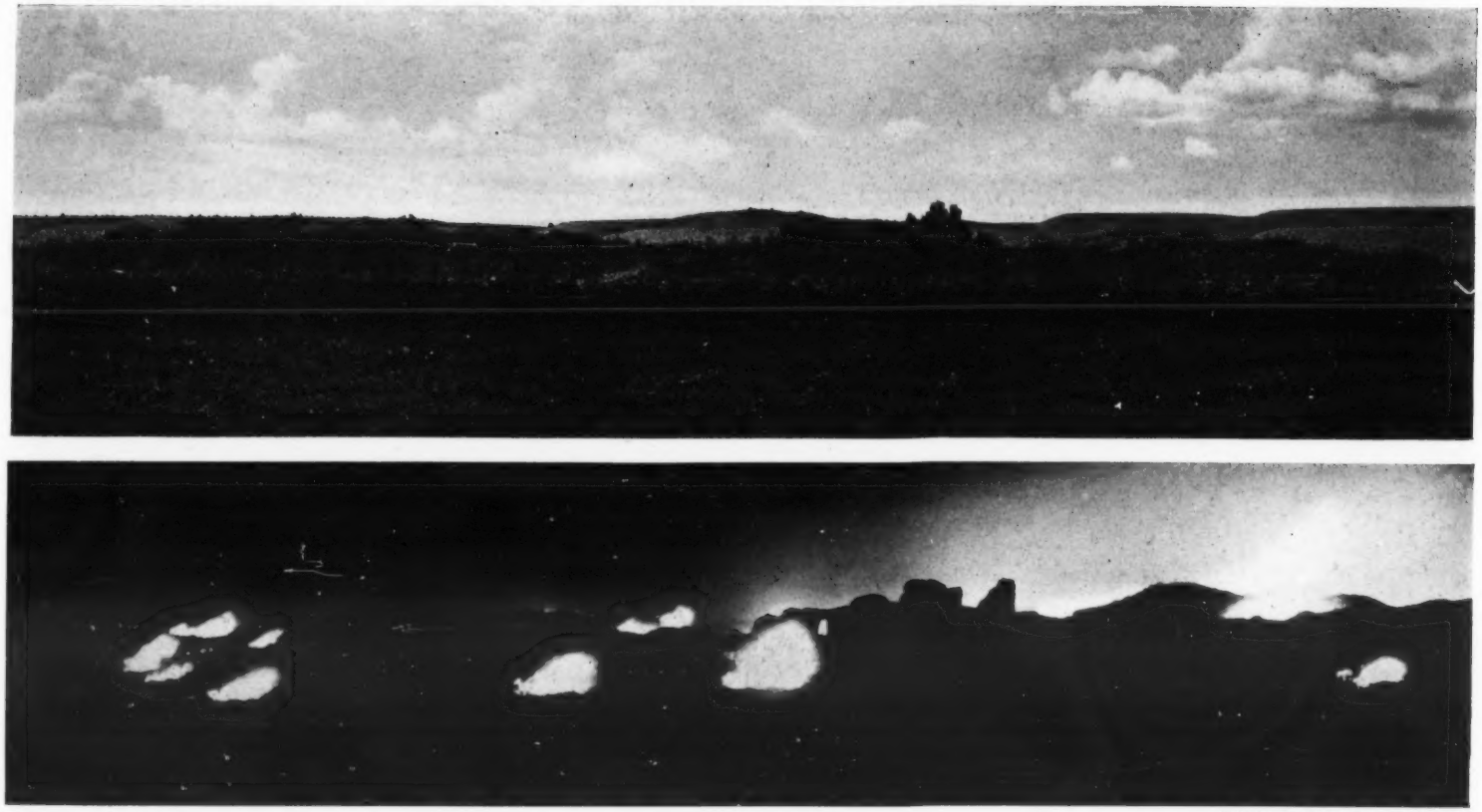


After Jackson

RESTORATION OF A PUEBLO OF THE "AZTEC" TYPE

Such pueblos were at once great fortified houses and villages, and are comparable, in the number of people sheltered, to the modern American apartment house, although different from it in that the principle of the pueblo was close communal coöperation. The buildings were so joined as to enclose three sides of a rectangular court, whose fourth side was protected by a low, outcurving wall. Only one entrance led through the outer wall into the pueblo, which was, therefore, easily defended. The three buildings, rising sheer from the ground on the outside with very small windows, rose within the court by receding steps, each a story high. Interior stairways were not in use, access being gained to upper levels by movable ladders. As a military contrivance, this plan could hardly have been improved upon, since an enemy would be forced to make not one, but a series of attacks, to get possession of the building.

The illustration, which is based on the ruins of "Hungo Pavie" in the Chaco Cañon, a fortified village similar to that at Aztec, gives a tolerably correct idea of façades and elevation, of the low, outcurving front wall enclosing the court, and of the mode of entrance by outside ladders, but it fails to indicate any doorway through the front wall, and pictures as too large the windows in the outer walls of the upper stories



Photograph by E. H. Morris

THE AZTEC PUEBLO RUIN

Upper view, as seen from the front or south side before the brush was cleared away. Behind the ruin rise the barren gravelly uplands which enclose the Animas Valley.

The lower view shows the burning of the brush at night after it had been cut and thrown into large piles

Photograph by E. H. Morris

THE MAIN PUEBLO RUIN AT AZTEC AND ITS SURROUNDINGS

After it was cleared of brush, the great ruin stood out in full view for the first time in many centuries. The total length of the main façade here shown is 359 feet and the débris at the extremities rises fully twenty feet, *i.e.*, to the top of the second story; while the standing walls in the center reach a height of about twenty-seven feet. The village was built on a growing alluvial fan, however, so that the lower story is at present partly buried in fluviatile deposit. Beyond the orchard, following the broken line of timber, runs the swift and often noisy Animas River, and in the grove, between the river and the sparsely covered hills, hides the peaceful little town of Aztec

Photograph by E. H. Morris

THE MAIN WING AT AZTEC

Central section of the main wing seen from the north while in process of repair. This is the best-preserved portion of the ruin, rising as it does well up on to the third story, or in all about twenty-seven feet, the first floor being several feet below the level of the foreground. In the left of the two rooms showing doorways intact, were found about two wagonloads of rubbish, mixed with which were discarded specimens of matting, sandals, cotton cloth, coarse and fine string, raw and tanned hide, numerous beads of turquoise, and many other objects of interest to the archæologist

Photograph by E. H. Morris

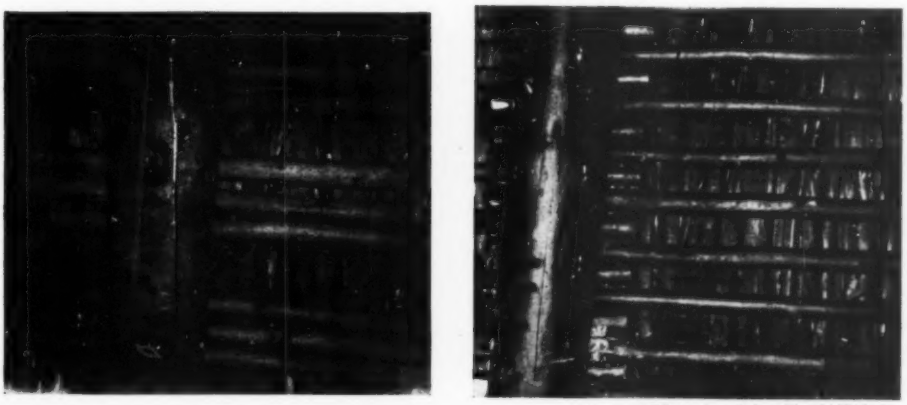
In order to discover as many as possible of the small and fragmentary artifacts, such as beads, in the floor débris, it is necessary to run this through one or more screens. Beyond the screen (in the photograph), running toward the Animas River, may be seen the expedition's winding tramway grade. In the distance rise the Knickerbocker Mountains

Photograph by N. C. Nelson

The excavation of Aztec was begun at the southeast corner of the ruin, the débris being taken to a distance by means of a tramway

Photograph by N. C. Nelson

Portion of the floor and wall of the circular and subterranean kiva, or ceremonial chamber, marked *KA* on the ground plan, page 86. In the immediate foreground is the fire pit, and beyond it the fresh air intake shaft, the smoke having to escape through the entrance in the roof directly above the fire. On the left may be seen the uncovered burial of a wolf, the precise significance of which in the ceremonial chamber is unknown at present



Photograph by N. C. Nelson

Many ceilings in the rooms of the lower story of the Aztec ruin are as perfect in all respects as the day they were constructed, probably some five or six hundred years ago. The beams are of spruce or pine, measuring up to twelve inches in diameter; transversely over these lie secondary timbers two to three inches thick, usually of cottonwood, spaced evenly or by threes; above these again is a layer of split rails, cedar bark, and twigs, the whole being finally covered with a four to six inch coat of clay (adobe), which constitutes the floor for the dweller in the story above. The same general method of ceiling construction is still used by the Pueblo Indians, and in fact by the Mexicans or Spanish Americans as well, but seldom with such neatness and skill

easily have housed the same number of people. Its main building is 359 feet in length, the east and west wings respectively 282 and 281 feet, but the actual space occupied by the village is somewhat larger, owing to the outcurving wall which encloses the court. Each of the building wings is from four to six rooms wide, and was three, and in some places possibly four, stories high. The walls, which are a little over three feet thick in the lower story, still rise to a height of twenty-seven feet. The secular rooms, which are always rectangular, vary somewhat in size, the smaller ones measured being only a trifle over nine feet square and the largest as much as twelve and one half by twenty-three and one half feet. The height of some of these rooms from floor to ceiling ranges from nine to eleven feet. The doors average a little over two by four feet and usually require one to stoop for passage. The windows or ventilating apertures that open out through the rear wall are all in the neighborhood of one foot square.

Of ceremonial rooms, which are circular in outline and more or less subterranean, there may be as many as thirteen in the pueblo. The greater number are incorporated in the buildings proper, but three at least are situated out in the open court. These "kivas," as they are called, differ greatly in size, the largest being apparently all of sixty feet in diameter while the smallest so far excavated is only about twelve feet. They also vary somewhat in details of construction.

The amount of labor involved in erecting such a village seems enormous when we consider that these people possessed no burden-bearing animals and no tools except such as were made of stone, bone, and wood. We are still more impressed on finding that in this particular instance the building stone used was quarried in the hills some four or five miles away. Likewise the great timbers employed, some of them measuring twelve inches or more in diameter, were felled on the mountain-sides, probably far up the valley, and transported at least in part by sheer human strength. The proverbially "lazy" Indian would seem to be a myth. And yet the Indian performed his task, we believe, as a free man, and not as the slave of royal taskmasters as in the case of those who built cities and monuments in Egypt and Mesopotamia.

How much of an enterprise it really was to erect such a fortified town, it would be impossible to convey to the reader at this time. The fact would hardly be appreciated even by a visitor to the site. But in the course of the four or five years of future work planned for the complete excavation and reparation of the ruin, we may expect that the enormity of the enterprise will become tolerably clear.

When we reached the Aztec ruin in the latter part of July, we found what appeared to be an immense heap of débris, almost entirely covered with a heavy growth of "chico" brush. By early September, the place looked very different. The brush had been cut and burnt, so that the ruin itself stood out in full view. The walls that rose above the general level of fallen masonry had been repaired, and from thirty to forty rooms, mostly in the east wing, had been cleared. It was merely a beginning, however—an experimentation, as it were—in ways and means. During the coming season we may hope for considerable progress. The task set is one calling not only for infinite patience with regard to scientific details but also for practical tact in dealing with men (even the visiting public is a problem),

as well as for mechanical resourcefulness. No work of quite the same character has been done before in the Southwest, so that it has been necessary to try out different methods to determine the quickest and best.

The work itself looks like ordinary labor, and may very easily degenerate into such. All scientific pursuits involve more or less of routine and drudgery, and this is especially true for those who are trying to reconstruct the life and history of prehistoric peoples. To wield the pen to any purpose, the spade must be handled first. But it is difficult indeed, amid dust and débris, through alternating periods of heat, cold, rainstorm, and desert dryness—the mind all the while occupied with rely practical problems—to maintain always the nicely balanced scholarly attitude. And there is no eight-hour law in archæology even for those who do not love their work. On the other hand, archæological field work, like other branches of research, offers its moments of exultation. In a way the excavation of ruins is like prospecting for ore—you always expect a strike and you are reasonably sure of getting it. But here again lies a real danger. My early notion of an archæologist was that of a bewhiskered individual gone mildly fanatic over something or other antiquated—perhaps arrowpoints. This tendency to find complete satisfaction in the object unearthed is always present, and the moment it takes full possession the archæologist is dead.

Possibly the reader may ask, "What then is the ultimate purpose of archæological research? Why all this expenditure of time and money if not primarily to recover relics of the past ages?" I have had to ask myself these questions more than once when hardships and difficulties arose which made it for the moment doubtful whether the game was really worth the candle. This period of doubt came about the time the mere novelty of the occupation had worn off, when the specimens found were no longer "curiosities." The conclusion reached was—and it is now an article of faith, so to speak—that of course the immediate purpose of excavation is to obtain "specimens," but that specimens after all are nothing but means to an end. The real mission of archæology is to make the unknown past live again or, in other words, to write history.

Some may question the possibility of stating anything of permanent historical value about the times lying beyond the invention of writing, or concerning any people who have not left us some written records. But if history is to be essentially a record of the general organic life and growth of the world's inhabitants, then archæology is in a position of vantage. A stone axe or a necklace of sea shells is an incontrovertible document, in certain respects worth more than any written document whatsoever. A proper interpretation of a complete array of archæological data from any given quarter of the world will be a far safer guide than any book of travels of the Mandeville type or any rhapsodical history of the Carlyleian order. The most sober historian is never completely unbiased, so that even admitting his sources to be infallible, his interpretation at its best will be only an approximation to the truth. Therefore a history based on documents other than those of the written sort has, within its own limits, genuine merit, and archæological research is amply vindicated.[1]

[1] The results of the work in the way of specimens found, will be considered in a later issue of the JOURNAL by Mr. Earl H. Morris, who is in immediate charge of the Aztec excavations.

Photograph by N. C. Nelson

PUEBLO PINTADO, OR PAINTED VILLAGE

This ruin is the easternmost of the group of fortified towns of Chaco Cañon (New Mexico) and is of the same general architectural type as the Aztec ruin. It is known locally as "Pueblo Alto," due perhaps to the fact that it stands in an exposed place on the continental divide and can be seen for many miles around. The north façade here shown measures about two hundred feet in length

Photograph by N. C. Nelson

PUEBLO WIJEGI, CHACO CAÑON, NEW MEXICO

This rather small but well-preserved ruin is of the same general architectural type as the ruin at Aztec. Its dimensions are about 120 by 225 feet and the masonry rises to about twenty-five feet. The semicircular wall, which ordinarily encloses the court in this type of village, is missing; this fact, together with the absence of any refuse heap, makes it seem probable that the place was not only never inhabited but never finished. The view shows the full width of the Chaco Cañon just below the point where it boxes up

Photograph by N. C. Nelson

PUEBLO CHETTRO KETTLE, CHACO CAÑON, NEW MEXICO

Except that it covers a larger area, this ruin resembles quite closely the one under investigation at Aztec, some sixty miles to the north. The ground plan is E-shaped, with a semicircular wall connecting the two extreme wings so as to enclose the south-facing court. In spite of apparent reduction, the buried lower story of this structure is largely intact. The main building, of which the rear wall still shows, is about 450 feet long. View taken from the north wall of the cañon looking southeast or upstream

Photograph by N. C. Nelson

PUEBLO BONITO, CHACO CAÑON, NEW MEXICO

This well-known ruin is the largest and probably also the longest occupied of the type of communal habitation to which the ruin at Aztec belongs. Bonito appears roughly semicircular in ground plan, but unlike other villages of its class and age, it has suffered enlargement and modification at different times so that the archæologist is unable at present to say what the original structure looked like. In places the rear walls are seen still to rise to the fourth story, but they are in imminent danger of falling owing maiuly to the fact that the timbers have been ruthlessly torn out for modern building purposes. Valuable unpublished collections of pottery and other relics from this site are in possession of the American Museum as a result of extensive excavations begun in 1896 by the Hyde Exploring Expedition, and last summer the writer made preliminary chronological investigations in the large refuse heaps lying in front of the ruin. The view shows the full width of the Chaco Cañon, its perpendicular walls and central arroyo, and also gives a fair idea of the general bareness of the entire region

The New Archæology

By CLARK WISSLER

THERE was a time when being an archæologist meant being a mere collector of curious and expensive objects once used by man. Such an archæology could make no just claim to a place in anthropology, the science of man. Its devotees vied with one another to possess the greatest number of unique objects, and under the stimulus of these interests the whole of North and South America has been ransacked to fill collectors' cabinets. But, while these activities have added something to our knowledge of man in the New World, they are impotent to answer the very questions we are all interested in; namely, how long has man been in America, whence did he come, and what has been his history since his arrival?

Geology finds in the earth the story of the world's origin and subsequent career, and in an analogous fashion the archæologist finds in the ground the story of man and his achievements. The new, or the real archæology is the study of these traces and the formulation of the story they tell. The fundamental questions we have enumerated above are not only very real problems, but very difficult ones. They are quite comparable to the tasks faced by the geologists. No mere collecting of curios, however fine or expensive they may be held to be, can in the least meet the exacting conditions encountered by the archæologist. He must actually dissect section after section of our old Mother Earth for the empirical data upon which to base his answers. It is not merely the finding of things that counts; it is the conditions and interassociations that really tell the story.

This is well illustrated in the case of a famous Chaco ruin called Bonito, a pueblo quite similar to the "Aztec" ruin. A good many years ago Bonito was dug into, and many fine pieces of pottery and other relics found there were brought to this Museum, where the choicest are now on view; but to the questions, "how old is Bonito, how long occupied," these fine curios can give no answer. Last summer, Mr. Nelson, the American Museum's veteran archæologist, worked several weeks on what was left of Bonito. He found that the ash heap, or dump, had always been in the same place, and by patiently dissecting a vertical section of this refuse he got the story of the ruin. We now know that the builders of this pueblo came to the site in a body and left again within a few hundred years. We know, also, that there were no important changes in their arts and industries while residing there. Such are the results of the real, or new archæology, as a part of the science of anthropology.

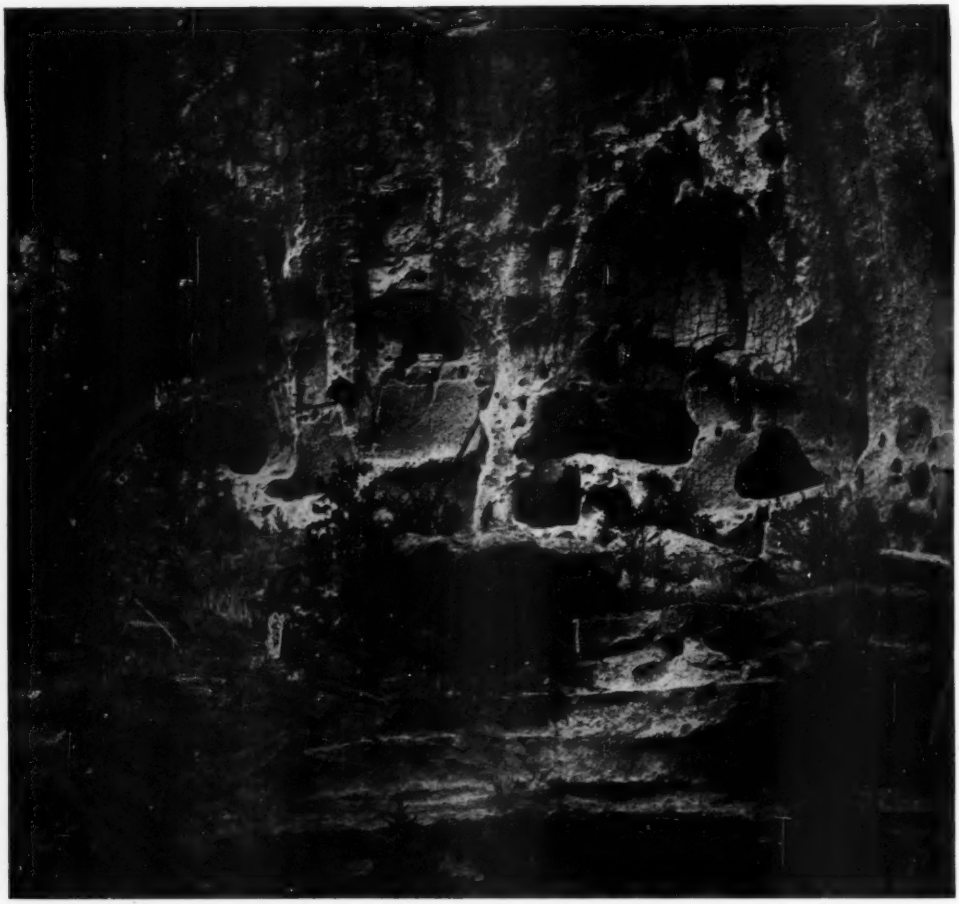
There is no mystery about such work. It is largely toil; but toil under the direction of a scientific mind. In the same way, Mr. Nelson and his associates have worked out the status of more than a hundred ruins in New Mexico and Arizona. It can now be told at what relative date each of these was built, which is one of the first great advances toward the story of prehistoric man in the United States.

It is not alone among the ruins of the Southwest, however, that the true archæological method is applicable. Long ago traces of man were noted in the Delaware Valley, particularly at

Trenton. They were found deep down in sand and gravel, suggesting great age. For many years these facts had been debated and discussed without definite result; but two years ago, Mr. Leslie Spier turned his attention to the Trenton sand deposits, dissecting them through and through with the same infinite patience. The outcome of this study is that we now know that the stone tools of man are found at one general level in the Trenton sand, and that they are a part of the pebble series for the same. In short, it is beyond dispute that the history of the pebbles in the sand is also the history of the stone tools. Yet, this sand deposit is below the soil and so situated as to indicate its formation at a time when the climatic conditions of New Jersey were quite unlike what they are to-day. Here again progress has been made toward the first step in the solution of man's origin in the New World.

Very much the same can be said of the question as to whether our North American caves were occupied by man at an early period. A good many years ago, when the first discoveries were made in Europe leading to the theory that there was a time when man's culture could be truly characterized by the term "cave dwellers," our archæologists examined many of the now famous caves of Kentucky and Virginia. They found that prehistoric man had entered these caves, but had left behind nowhere such clear-cut evidences of his successive appearances as in Europe. It was concluded, therefore, that all these traces of man belong to a very recent period. Last autumn, however, Mr. Nelson made a careful study of Mammoth Cave. He made careful vertical sections in the accumulated deposits near the entrance to the cavern, and by the minute dissection of these, found a definite difference between the cultures represented here and those of the historic Indians. There is now every reason to believe that the culture of the Indians found in Kentucky by our first explorers was not the initial culture of that area. There is every hope that the use of proper methods of research will give us a chronological series for the whole Ohio drainage.

We cannot here describe the new methods that were used to get these results. They belong to the technique of the subject, but we should not forget that every field excursion of an archæologist will bring him face to face with a case a little different from anything he has encountered before. The new situation must be analyzed and dealt with as its nature requires. So, in short, the real equipment of an archæologist is a scientific mind. As soon as archæology ceases to strive for the mere collection of fine objects or curios, and turns to problems, it makes discoveries. We may justly take pride in the appearance of this new science, partly because our own Museum has played a conspicuous part in its inception, and partly because it will hasten the day when our archæological exhibits can be made to tell the true story of man's career in the New World.



HUMAN SWALLOWS' NESTS IN THE CLIFF

This term seems the best description for those small, rounded rooms, made by human hands long ago in the volcanic tufa of the cliff. They formed the homes of the Pueblo Indians in such places as Puyé and the Rito de los Frijoles (see page 110). One needs almost to have wings to gain access to some of them, for long, shaky ladders (like that in the center of this picture) are far from reassuring. In past times when wooden shelters, long since fallen to decay, were reared on beams projecting from the small holes about the openings of the cliff rooms, the Indian women, gaily dressed like their sisters of today, and less like swallows than tropical birds, darted in and out of doorways or climbed the ladders with jars of painted pottery on their heads

In the vicinity of Mount Taylor, between Cabezon and San Mateo, a most striking sky line is formed by volcanic peaks of varied shapes. Here we see the "Alesna," or "awl," so called, no doubt, on account of the sharp point it presents

Camp Life in New Mexico

THE ENCHANTMENT OF WANDERINGS AND STUDY AMONG ANCIENT INDIAN RUINS IN THE AMERICAN SOUTHWEST

By ETHELYN G. NELSON

IT is now more than four years since I began to follow in the wake of an archæological expedition to New Mexico. I confess it was with considerable trepidation that I first embraced the idea. The picture brought to mind by the mere mention of this corner of our country was one in which heat, sand and drought were the main features. What a change has been wrought in my opinion by these five years' experience may be judged by the fact that I now look forward with the greatest eagerness to the early spring days when we may again start forth on our wanderings through this land of enchantment.

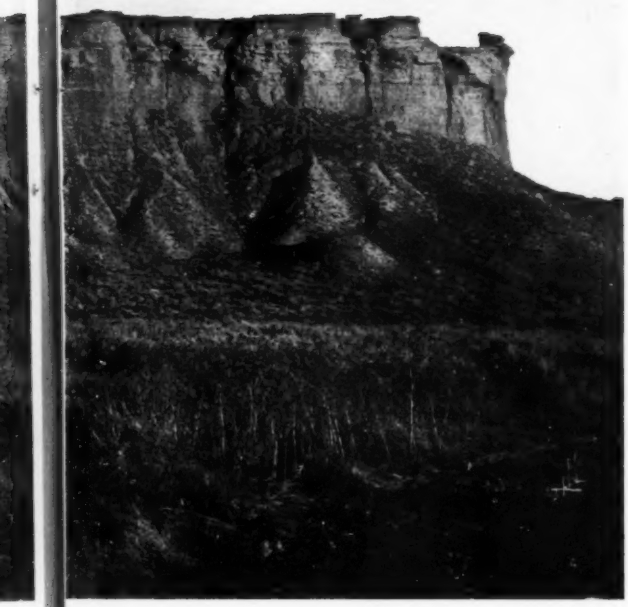
Truly a land of enchantment! There is a spell in the deep blue of the sky, an exhilaration as of wine in the air, and a charm in the very immensity of the unpeopled spaces, in this little-known section of the United States. Here, too, the romance of olden times is still maintained, for the cowboy rides the range, and the trapper and the treasure hunter are frequently met with. Weird and wonderful are some of the tales told by these natives as they visit with us around our evening camp fire, and we listen, interested and credulous as we might not be elsewhere, for the spell is upon us.

My first summer of camp life in New Mexico began in the vicinity of the picturesque village of Galisteo. I well remember my introduction to it. After a walk of some three miles from the desolate little railroad station, whose newly appointed agent seemed scarcely aware of the existence of the near town, we came suddenly to the edge of a rise

Camp at Mesita de la Tapia, on the Rio Puerco.—Around the base of the high rock are traces of about ninety small villages, while the round hump on top indicates the ruin of a village of some size, to which the valley dwellers probably retreated in time of trouble. Access to the top is fairly difficult and could easily be barred. The only spring for miles around is situated just to the left of the tents

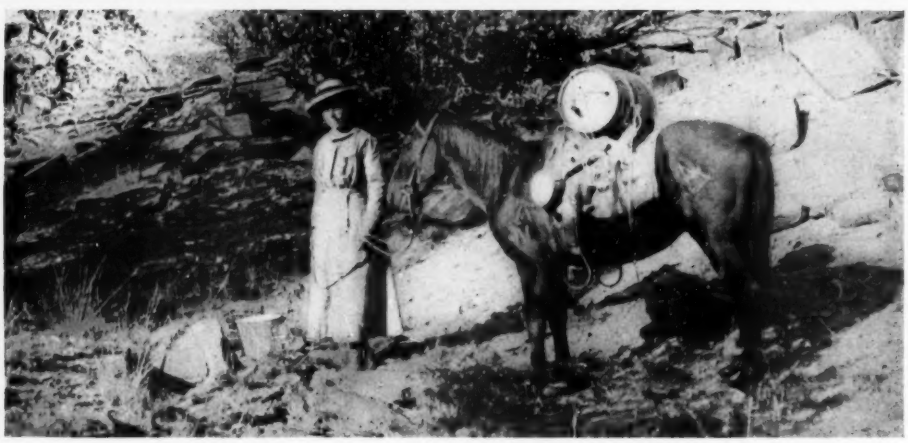
of ground and looked over on what appeared as an oasis in the desert. A little white church stood in the midst of a group of adobe houses, while apple orchards and great cottonwoods shaded the whole. Just beyond, the new bridge spanned the stream that winds its way through the town. We hastened on our way, and were soon resting in a room in the cool depths of the rambling adobe structure where Señora Davis, mother-in-law of the only English-speaking resident of the place, the merchant, puts up chance wayfarers. From this vantage point we began to explore the surrounding country for ruins, being ably assisted by a Mexican driver whose name, Anaya, soon became twisted into Ananias on account of the casual way in which he used the truth when an extra five dollars for a day's work was in sight.

Mrs. Davis' hospitable abode was soon afterward exchanged for the open-air existence which was followed until the snows fell. Sometimes the twelve by sixteen foot tent was our complete apartment, forming sleeping and living rooms as well as kitchen and dining rooms; while at other places we made use of rock shelters, green-covered arbors, or real caves, to supplement or entirely supplant it. From using a two-burner gasoline stove in cooking during our first summer, we were reduced to the open camp fire in the last expedition, where the nightly change of camping site made it necessary to do away with everything but actual necessities. Sleeping cots were discarded for the ground, and a board on a box replaced the usual camp table —demonstrating the uselessness of too great luxury.



Our camps have ranged through all varieties of scene, from the flat, sandy, desert abomination, to the beautiful sheltered spot with towering cliffs of varicolored sandstone overshadowing it. There have been springs and streams of water in places, and drought has been our lot in others. I am reminded of a time when we had more water than we needed. It was one evening when we were moving camp. The day had been fine, but as we were loading the last of our things on the wagon, there came up one of those sudden thunder storms common to the region in summer and fall. Soon the pitchy darkness was relieved only by the continual sheets of lightning. By the time we reached our destination, a rock-shelter camp, most of us were drenched to the skin. The usually dry arroyo between the rock shelter and the place where a careless driver had dumped our belongings, had become an impassable torrent, so that we were obliged to huddle in the cave until midnight, before our bedding (fortunately protected by heavy canvas) could be rescued.

The first summer the work of the expedition was carried on along lines that necessitated camps of a more or less permanent nature, as compared with those of the season just closed. The rock-shelter kitchen at San Cristobal—which Senator Pankey, the owner of the "81,000 acre ranch" on which it was situated, persisted somewhat to our confusion in dubbing "Honeymoon Camp"—became quite like home before it was finally abandoned. Our workmen, all Mexicans, soon became old friends and we found them waiting for our return the next season to resume work for us. Most of them spoke no English and were a happy-go-lucky set, being quite content apparently with today's frijoles and black coffee, with no thought for the morrow. They no doubt had their opinion of folks who would spend so much time and money digging holes in the ground and collecting worthless bits of bone and pottery, but they were polite enough to keep it to themselves. Old "Socrates" was so named by the head of the expedition because of his great knowledge of everything on earth or in the heavens above. No question could be put to him that he was not prepared to answer, and he had a name and a use for every plant that grew in the vicinity. All this past summer we drank a wild tea recommended by him and found it good. He had stories of buried treasure, supposed to be well guarded by the Indians; and he wanted a chance to dig in the old church ruin at San Marcos, but when there later on, his natural aversion to hard labor overcame his greed for gold. One young fellow brought into camp his wife (a mere girl of about fifteen years) and baby, with all their personal



In archæological field work there are few holidays. When the excavation is not actually in progress, there are always plotting, mapping, and cataloguing to keep one busy

This rock shelter, formed by one immense bowlder tipped against another, was once an Indian abode. A little excavating and a few yards of mosquito netting transformed it into a very acceptable dining room and kitchen during the hot months

The water near the camp was often too alkaline for use. At San Cristobal it was necessary to bring water by wagon from Galisteo, six miles away. Sometimes the saddle pony was requisitioned to bring water from a near spring

belongings even to the kitten—which was unfortunately captured by an owl. Another workman brought his newly made bride for a honeymoon trip. He, it was said, had been the victim of the folly of the higher education. Having been at school and therefore qualified to act as postmaster, he had tried to defraud the government, for which he had spent one year in the "pen." Apparently, however, this experience had not detracted in the least from his own or his bride's admiration for himself. Before leaving camp he begged that their pictures might be taken as souvenirs of their happy time there. This matter of having pictures taken, by the way, was something that greatly fascinated the natives, even the Indian boys sometimes requesting it. A group of cowboys one day held us up for a half hour while they posed on their horses; and families near our camps were sure to make similar requests.

As I glance back over this last wonderful summer, with its kaleidoscopic changes, my mind is crowded with varied images. With scarcely any pause in our daily travel from the last of May until the last of October, except for the month at Aztec, new scenes kept unfolding before us. Towering cliffs, weathered into all sorts of fantastic and beautiful shapes, melted into vast plains of sagebrush-covered sand, again to be replaced by piñon and cedar-timbered hills carpeted with many kinds of wild flowers.

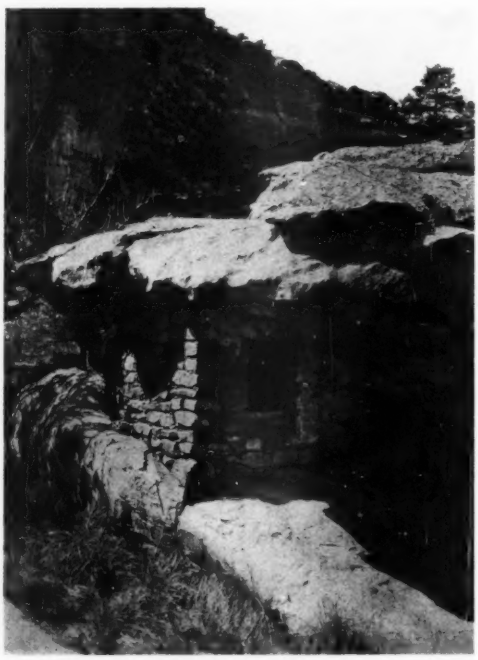
Measuring the rooms and taking an inventory of the contents occupy a large part of the time when excavation is in full swing. In the background of this picture, taken at San Cristobal, may be seen the remains of a church built by the Spaniards some three hundred years ago

Little Mexican towns are tucked away in the most unexpected places, the low adobe houses so blending with the general landscape that if it were not for the relief afforded by strings of scarlet peppers and by a few fruit and

cottonwood trees, they might almost pass unnoticed, or be thought merely a part of the adjacent cliff. They remind one of scenes in Palestine, and the solitary shepherd surrounded by his sheep on the bare hillside, or the old woman going to the stream with her water jug, serves to enhance the illusion. It strikes the newcomer oddly to find that English is seldom spoken in these towns, the Mexican language prevailing everywhere except in the larger centers.

The Indian villages, however, so often perched on the tops of inaccessible mesas, are much more strikingly picturesque, while the Indian women are like birds of bright-colored plumage as they dart in and out of their doorways or climb the ladders with jars of painted pottery on their heads. Their love of brilliant hues in their dress contrasts with the taste in garb shown by the Mexican woman, who is usually clad in somber black with a shawl of the same color thrown over her head. One's imagination tries to picture the old life of these Indian women when they occupied the rows of caves or the cliff dwellings which line the walls of the Frijoles Cañon near Santa Fé. I still see that ceremonial chamber high up in the cliff, with its three long shaky ladders, where I confess that my courage failed me ere I reached the top.

Ruined villages, the search for which led us all over northwestern New Mexico, seem in great part at least to be situated in the most picturesque localities; so while the Indian may have selected his dwelling place with many other things in view, I for one am convinced that he had an eye for the beauty of his surroundings. I feel grateful to him for this, since in this way we also were brought to these spots. From a place called the "Point of Mal Pais," we traveled for miles through the Angostura, a narrow rocky cañon with stupendous cliffs on one side and the black lava flow on the other, to emerge at evening into a beautiful meadow where we found a spring of water and luscious grass for the horses. We camped in a sheltered *rincon* near a natural sandstone bridge of great beauty. Opposite, across the valley, was another wonderful rock formation resembling a great cathedral. As the sun sank be-



This ancient Indian guardhouse, built under an overhanging ledge high up in the cliff, is not so easy of access as it would appear from the picture. In fact, I almost gave up trying to reach it across the steep face of the rock. It is neatly finished inside, but is too small to have been used as a dwelling

hind this rock we vowed that we would again return to enjoy this charming spot at our leisure. Before noon of the next day we were at the ruin on the high mesa overlooking all this valley land and the black lava country beyond. In the sides of the rock were little cliff houses where the guard for the crops was no doubt posted in those olden days. We were loath to leave. That evening we had a memorable horseback ride up the cañon to another even more picturesquely situated ruin, where a little stream of water from a spring came tumbling down the hillside. It was dark when we galloped back into camp, where a roaring fire had been prepared to light our return.

It was in October, I think, that we came one evening near the Indian village of Santa Ana, and it was raining. We had passed through the more sheltered wooded section of that part of the country to the sandy wastes opposite Santa Ana, hoping to cross the stream into the town to procure feed for the horses. The river had been rising, however, and we were obliged to turn back after crossing part way. We shall none of us soon forget that experience. The rain was descending in torrents, the wind blowing a gale, and there was no shelter. The little sleeping tents were hastily set up on a sand hill, and after drinking a cup of coffee made over the flame from a burning packing box, we took refuge in our beds. The poor horses had a sorry time, with no feed and only such slight protection as the shelter of the wagon might afford.

From this time on until we arrived again at Aztec, our experiences were somewhat checkered. At Jemez Springs, a truly beautiful place, where the hot sulphur water bubbles joyously from the ground and a fine stream of water tears madly down the narrow cañon, we rested a day while the sun shone, to dry our belongings and take advantage of the baths. This was in a forested region at an elevation of nearly eight thousand feet. Now if it hadn't been for the kindness of heart of the head of the expedition, who decided that we stay another day for the benefit of the horses, possibly he would not have lost himself on top of the mesa in the bitter cold, and perhaps our little saddle pony, Daisy, would not have become lamed in some mysterious manner. On that fateful morning—it was Friday, the thirteenth—the leader of the expedition (after deciding that we remain the additional day for the sake of the horses) concluded that good time must not be wasted and that therefore he would take this occasion to locate definitely the ruins said to lie on the mesa opposite camp. He decided thus, in spite of the fact that the sun was again sulking behind the clouds and there was every indication of rain—for an explorer must often take chances if he is to gain results. He shouldered his knapsack soon after breakfast and set forth. When it began to rain later on, we thought he would surely return. He did not come. The situation of our camp, so pleasing in the sunshine of the day before, now had all that dreariness of aspect which a cold, drizzling rain and wet soggy ground can produce. I retired to the tent and tried to keep warm by a lantern, while I read or sewed. The day dragged away and when darkness began to descend I became seriously alarmed, especially as we found that the footbridge across the stream had been washed away by the rising current. Visions arose of all sorts of calamities which might befall one who was wandering alone in the forest without shelter or food. Little sleep came that night, and great was the

THE RITO DE LOS FRIJOLES

Here in a narrow cañon some thirty miles from Santa Fé, the former homes of the Pueblo Indians are represented by ruins on the valley floor, as well as by many cave dwellings in the vertical face of the cliffs. The bottom of the cañon is reached only by a very steep trail. The ruined villages of New Mexico are frequently situated in most picturesque places, as if the Indians appreciated not only the convenience and defensibility of their homesteads, but the beauty of the landscape as well

A group of friends.—A common feature of the landscape in New Mexico is the weathering of the sandstone cliffs into all sorts of quaint shapes, often requiring but little imagination to transform them into faces, animal forms, or more imposing architectural designs

According to legend this well-known rock, the Mesa Encantada, was the home of the ancestral race of Acoma Indians. It is now practically inaccessible, only a few adventurous explorers ever having reached the top. The cliff is nearly 450 feet high

One of our most picturesque camping spots was at this natural bridge near Cebollita. Small Indian ruins are on the flat just below, and much larger ones on the mesa top near by

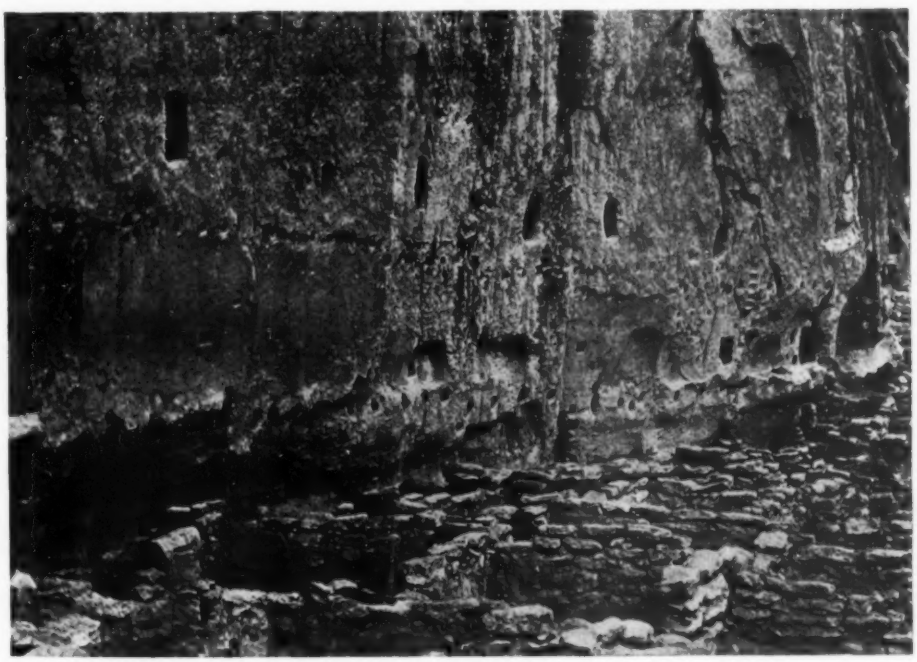
relief soon after daybreak to learn that the "padron" had been sighted on the opposite bank near a Mexican house. Soon he was in camp, reciting adventures of a compass gone wrong because of water in it, of a lost trail, and, after continual wandering through the day and into the night, an uncomfortable time passed in an adobe hut trying to dodge leaks in the broken roof.

Hot baths and sunshine soon effaced the memory of this disaster, and it was not until we were ready to resume our travels and found poor Daisy disabled that we began to wonder if our good luck had left us. But the walking over the rocky road was not bad and we trudged gaily onward. Of course there was the wagon, but the horses always seemed to have about all they could pull. There was snow on this mountain, too; and while I will not say that I walked barefooted over it, as some one has intimated, yet I must admit that my worn footgear by this time was not such as to yield much protection.

It was not many days before we were obliged to leave the lamed pony along the way with a Mexican friend of the driver's, since from lack of proper attention, combined with having to travel every day, her injury had grown worse instead of better. As a final disaster, the kingbolt of the wagon broke off short as we were crossing a deep gully one day, with no blacksmith shop inside of thirty miles. Having by this time grown somewhat philosophical, we sat

Digging for spoils.—Work with pick and shovel is not ordinarily considered attractive, but there is a fascination about delving in a buried house with the hope of unearthing a choice piece of pottery, that makes one forget the labor involved

This November camp on the edge of the forested region at Arroya Hunga near Santa Fé, elevation seven thousand feet, is a vivid contrast to the rock shelters or green-covered arbors which sometimes were our stopping places. It is this variety of experience which gives zest to the freedom of the gypsy life



The back wall of this ruined pueblo was formed by a cliff in which may be traced rows of holes chiseled out for the ceiling timbers of the rooms whose walls appear in the foreground. Although this was a two-story building, indications of a lone room to a third story may also be seen. The larger openings were entrances to chambers probably used for granaries because of their secure position and protection from rain

calmly down by the roadside and waited while a messenger returned to the settlement we had last passed through and borrowed a new bolster for the wagon. In a way this last accident was providential, for the fact that the bolster had either to be returned within a certain time or paid for, tended to hasten on the expedition. In about two weeks from the day we left Jemez Springs, we arrived at Aztec, having walked nearly every step of the distance, something over two hundred miles.

It has been suggested that we use an automobile on these trips instead of a prairie schooner. I can only say that I wish any one who thinks this, might be set down on a certain piece of road over which we traveled after leaving Jemez Springs. Twice we unloaded the wagon and transported the goods piecemeal, before we reached a comparatively good track. It took considerable imagination to call those stretches of rocky hillside and gully roads, and although it was possible to get over them with a wagon I think an automobile could scarcely have made the trip.

Even difficult experiences and disasters, however, cannot dampen the enthusiasm of those who love the gypsy life with all its freedom. We find real joy in rising at five o'clock on a summer's morning—to eat a breakfast that would astonish the jaded appetite of a New Yorker. Then, hustling the camp equipment into the wagon, we are off at seven, walking perhaps ten or twelve miles before the noon halt is made. The sun may be hot, but the air is so invigorating that it matters not. We reach a ruin where, perhaps, I am seized with a desire to probe into the refuse heap for buried treasures, while the archæologist is taking his measurements and pictures. One forenoon I unearthed seven pieces of pottery in this way, before it was necessary for the expedition to move on.

But no! I am sure that it is quite impossible to make any one realize the charm of an existence like this, by merely telling about it. One must be there and do things and get the "feel of the country" into his blood, and then, unless he be tied too firmly to life's conventionalities, he will return again and yet again.

In the high altitudes of the Southwest we always had a camp fire, even on a summer's evening, but in desert regions firewood is not to be had. Often very weird and wonderful were the stories told by cowboy, trapper, and treasure hunter, as they visited with us about the fire at night

REPRODUCTIONS IN DUOTONE OF PHOTOGRAPHS FROM THE AMERICAN SOUTHWEST

BY HERBERT J. SPINDEN AND EDWARD S. CURTIS

From the copyrighted photograph by E. S. Curtis

MÓSA, A MOHAVE WOMAN

The Mohave inhabit the very hot lands along the lower course of the Colorado River. Although their country is commonly accounted a desert, the Colorado in that region, like the Egyptian Nile, has seasonal overflows, making possible the raising of corn. The people paint themselves with mud and take pleasure in mud baths. Although less advanced in the arts than the Pueblo and Piman tribes, they are an interesting people, and especially notable for their splendid physique

Photograph by Herbert J. Spinden

AN ACROPOLIS OF THE SOUTHWEST

The Hopi village of Walpi is situated upon the tip of a sandstone mesa that rises eight hundred feet above the arid plain. This site appears to have been chosen in early Spanish times for its defensive situation. Nevertheless the architecture is purely Indian. The inhabitants show in their customs the splendid isolation which is seen in this view of their citadel, and maintain to the present day such ancient rites as the famous snake dance

Photograph by Herbert J. Spinden

A TRAIL IN THE TEWA COUNTRY

The Tewa Indians live in six villages located along the Rio Grande and its tributaries to the northeast of Santa Fé. The sparse vegetation of the region consists of dwarf pine and juniper and straggling sage, but along the horizon on all sides rise timbered mountains. The trail shown in the picture leads north to the pueblo of San Ildefonso

From the copyrighted photograph by E. S. Curtis

VASH GON, A JICARILLA

The Jicarilla Apache formerly lived on the upper Rio Grande in New Mexico and at the eastern base of the Sangre de Cristo Mountains of Colorado, and were in touch with the buffalo-hunting tribes of the Great Plains as well as with the more civilized peoples of the Southwest. Today they live on a reservation to the west of the Rio Grande in the northern part of New Mexico

From the copyrighted photograph by E. S. Curtis

CAÑON DEL MUERTO, IN THE NAVAHO COUNTRY OF NORTHEASTERN ARIZONA

This "ravine of the dead," a branch of the monumental gorge of Cañon Chelly, cut through hundreds of feet of reddish sandstone, takes its name from a cliff dwelling in which were found several ancient mummies. A portion of the cañon is to be reproduced in the Navaho group now under construction for the Southwest Indian hall of the American Museum of Natural History

Photograph by Herbert J. Spinden

ON THE SUMMIT OF HERMIT PEAK, NEW MEXICO

This rocky outpost on the eastern front of the Sangre de Cristo range rises to the height of twelve thousand feet. A peculiar religious sect, called the "Brotherhood of the Hermit," has erected crosses upon the summit. Looking to the east from the top one sees the land falling off rapidly toward the Great Plains, and to the west, a wilderness of mountain ridges. The forests on the mountains of New Mexico consist mostly of pine and mountain cottonwood

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From the copyrighted photograph by E. S. Curtis

THE STORM

The Apache and Navaho tribes are hunters and warriors, the nomads of the Southwest, in striking contrast with the sedentary Pueblo Indians. The Navaho, the largest pagan Indian group, numbers between thirty and forty thousand. They raise sheep and have adopted a few of the customs of the white man, but still use their primitive dwellings and keep up their old religious ceremonials. As the supply of game disappeared, these hunting tribes have been forced into cattle stealing. It is only in recent years that they have been brought into complete subjugation; Geronimo, the last of their chiefs to give trouble to the Government, died in 1909, a prisoner of war of the United States

Photograph by Herbert J. Spinden

THE VALLEY OF SANTA FÉ, NEW MEXICO

The history of Spanish occupation in the Southwest centers about Santa Fé, the city of the Holy Faith, which was made the capital in the first decade of the seventeenth century. Remains of a prehistoric village of Pueblo Indians are found here. During the interregnum of the great rebellion, 1680 to 1693, the Indians of Galisteo occupied the town and built their many-storied structures around the plaza

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The Meaning of Bird Music

By HENRY OLDYS

WHEN, on some dark, overcast night in late September, there come to the ear from overhead sundry piping or chirping notes, it is easy to recognize them as auditory signals holding together certain flocks of migrating birds on their annual journey to the South. But when one of these migrants, while returning to its summer home, perches on a twig and, with head thrown back and throat vibrating, pours out a series of orderly tones, the significance of the utterance is not so apparent.

It is now the well-settled opinion that such utterances do not find their primary stimulus in courtship and mating. Darwin's theory that the choice of mate on the part of the female is an important factor in development of song in the male has been sufficiently discredited by Herbert Spencer, St. George Mivart, August Weismann, and others, and is now discarded by virtually all the leading students of evolution. It is, of course, undeniable that songs, like plumage displays, are used in connection with courtship; but such use is merely an incidental one, as it is with human beings, and is probably seldom, if ever, the determining factor in the female's choice of a mate. Moreover, even on Darwin's assumption that the finest singers mate most easily and so transmit their superior qualities by inheritance more frequently than singers of a lower grade, thus gradually improving the race musically, it is doubtful if such progenial transmission of musical qualities would prove to be the chief means of progress, in view of the important part played by acquisition of song by imitation in musical improvement among birds. It is well known that the singing powers of canaries are not produced by breeding from gifted ancestors, but by associating the birds with unrelated superior singers known as "campaninis," which are kept for this special purpose and which often command very high prices. Wild birds similarly improve their singing by imitation of better singers of their own species, as is evidenced by several direct examples of such imitation which have come to my personal attention. Furthermore, few female birds sing; and it seems most probable that if they possessed sufficiently discriminative ears to appreciate and select the finest singers among the males, they would themselves become singers.

But if Darwin's theory of sexual selection be inadequate to account for the development of bird song from the original unmusical ejaculations to the present melodies, what is the true cause of such development? The simple and natural answer is that musical evolution among birds is due to the same causes that have produced musical evolution in man, especially as the results of the two streams of evolution show marked resemblances.

It is customary, at the present time, to deprecate any interpretation of animal behavior in terms of human behavior—to attempt to explain all actions of the lower animals on the basis of different psychical processes from those producing similar actions on the part of the human species. This attitude expresses the natural reaction against the popular tendency to overhumanize the lower animals. Unscientific minds as-

sume for the behavior of all animate beings the same mental causes that would produce such behavior in themselves; but scientific minds, in combating this error, transgress equally in the opposite direction. Such reactions generally go too far. Thus the constant use of consecutive fifths and octaves for several centuries in the earlier stages of our modern music has led to a rabid proscription of such harmonic progressions; and a later overindulgence in the chord of the diminished seventh has brought that attractive and serviceable combination of tones into almost equal disrepute. Hence, the complete humanizing of the animal world by ignorance has led to the complete dehumanizing of it by learning. It is the reverse swing of the pendulum.

Disregarding the many physiological likenesses between ourselves and these fellow creatures of a lower evolutionary stage, science emphasizes the physiological differences and makes them the basis for an almost totally different psychological method of arriving at results. Yet, as in the human mind instinct mingles with reason, so in the animal mind reason mingles with instinct. When we are confronted with two musical evolutions paralleling each other remarkably, the most rational supposition is that such evolutions are alike in their origin and in their sustaining causes. The birds display evidence of enjoyment of their songs; they manifest a proneness to sing freely when happy and to be mute when unhappy; they show a seeming interest in the performances of more accomplished singers, and an apparent desire to acquire phrases and tones that excel their own; they exhibit much knowledge of the value of rhythm, of melody, of tonality, and even of sequence of related musical phrases; in all these things paralleling ourselves. An explanation of these attributes on any basis but that of musical appreciation (by which human attributes of the same kind are explained) would be most complicated, far-fetched, and altogether unsatisfactory. The rule adopted by investigators of the psychology of the lower animals is never to accept an explanation based on higher psychical processes when one based on lower psychical processes may be made. A useful rule; but it is easily metamorphosed into a rule never to accept a simple, direct explanation when a more complicated, indirect one may be assumed. And many of the interpretations of psychologists seem to be governed by this derived (and pernicious) rule.

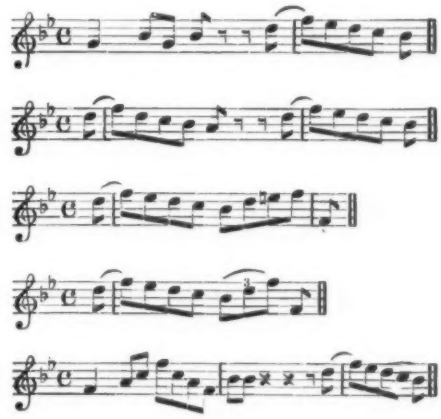
As with man, so with birds, the development of musical appreciation ranges from zero to the maximum. While the impulse to express emotion vocally is common to many creatures, such expression in musical form is limited to comparatively few. The dog barks his joy, the bull roars his defiance, the cat purrs her content, the hog grunts its satisfaction, but utterances of this character can by no legitimate stretching of the term be described as music. So, too, among birds the rattle of a kingfisher, the scream of an eagle, the squawk of a parrot, cannot be classed as musical performances. Nor is there any physiological line of demarcation between musical and non-musical birds. The crow and grackle, although properly classed structurally with the Oscines, or singing birds, are lacking in musical expression; while the wood pewee, dove, bobwhite, and others beyond the pale physiologically, express themselves musically, the wood pewee taking high rank in this regard.

Even the common barnyard cock will occasionally express his exuberant feelings in true melody, as in this pæan with which I heard a Maryland cock greet the dawn on a November morning:

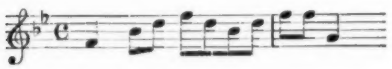
and in which the final descent of the gamut was accomplished by distinct steps, unblurred by any *portamento,* or slur, and in good strict time. Many of the Oscines that may properly be classed as melodists hold their title by a very slight grip. The lisping or buzzing songs of most species of warblers, the incoherent utterances of purple finch, goldfinch, warbling vireo, junco, and like singers, the twittering chirpings of swallows, the monotones of nuthatch and chipping sparrow, and the indeterminate notes of house wren, indigo bird, and English sparrow (in his rare musical moods)—these performances, although often pleasing to the ear, are almost entirely lacking in melody, as known and enjoyed by man; while the dickcissel expresses his emotions in articulations that seem to belong to speech, rather than song.

On the other hand, some of the avian melodists are entitled to high rank as musicians, even when judged by human musical standards. Many of their productions, although brief, excel in melodious beauty the best efforts of some primitive human races, and a few are worthy of a place beside the melodies of the civilized world. Here is an attractive passage[1] in which a theme in a minor key is followed by the same theme in the relative major key, with a change from *piano* to *forte* that gives a distinct touch of brilliancy:

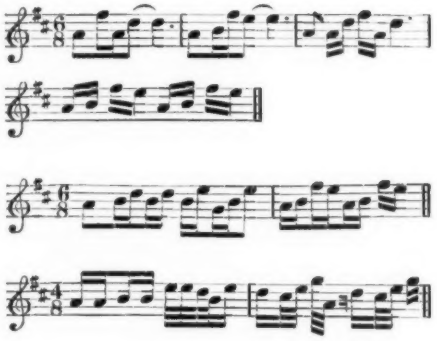
This is not, as might be thought, an extract from the note book of Mozart, Bach, or Mendelssohn, but an excerpt from the song of a rock thrush (*Monticola saxicola*) I heard in the Worthington Aviary at Shawnee-on-Delaware, Pennsylvania, four or five years ago. The notes were perfectly true to pitch and were given in a quality of tone that was exactly that of the human whistle. The attendants at the aviary had picked up the bird's phrases, and during my three days there I could never tell without inquiry whether the bird or an attendant was responsible for any particular rendering of them I happened to hear.

Like the true little musician that he was, the thrush avoided monotony by varying his utterances, sometimes with different themes, sometimes with different combinations of themes. His ingenious use of the second theme of the song quoted above appears in the following notations of some of the combinations:

But while the theme that plays so prominent a part in the examples I

[1] Although the fact is unimportant, it may be stated that all the bird songs given in this article were sung an octave higher than they are here written.

have given of the bird's music was a favorite with him and was freely used, he had several other phrases in which it did not appear. The following one will be sufficient to indicate the general character of the rest of his music:

It will be apparent to any musician, of however humble rank, that the music here written (and it is an exact transcription of the notes sung by the bird) is perfectly comparable to our own music of this twentieth century; and not only in the use of the same scale, but in rhythm, melodiousness, and harmonious balancing of phrases. Careful examination will disclose several effective touches, such as the use, in one of the combinations given above, of the E♮ before the following F's.

The rock thrush is found in southern Europe, and, if I may safely judge from my own experience with this one individual bird and from the rank accorded the species by some observers of it in its wild state, I should say that it is of all European birds the most melodious—using the term in its proper sense and not in the loose way in which it is generally handled by a careless public. Its chief rival seems to be the European blackbird (*Merula merula*). Personally I have little knowledge of the singing of the blackbird, although I have noted one or two utterances from some in American zoölogical collections that indicated the high musical character of the bird in its native wilds. I am able, however, to reproduce three blackbird songs of a very choice quality musically, which were recorded at Sèvres, France, a few years ago by an accomplished musician and lecturer on music, Mrs. Amelia von Ende:



These three songs disclose a strong feeling for harmony as well as for melody. The alternation of tonic and dominant harmony in the first is very effective, while the pleasant modulation to E minor in the second is quite satisfying. Particular praise must, however, be accorded to the third song, which presents an attractive, sprightly, and well-developed theme.

But it is not necessary to cross the ocean to obtain examples of good music from birds; our own land is the home of some of the best of avian musicians. I have secured several four-phrase songs from our own thrushes which in beauty of melody and arrangement of themes surpass all other avian music that has come to my attention, and we have other species that take high musical rank. The song sparrows furnish melodies enough to equip nearly every member of the woodland chorus with a different song for each. Some of these song-sparrow themes are very satisfying. Here is one I heard in northern Ohio last spring:

This, although simple, is a very pleasing and melodious phrase, one that no human musician need be ashamed to borrow for incorporation into some

more elaborate composition of his own. And let me say here that our woods and fields are full of suggestive themes for the enterprising musician who awakens to the fact that man has no monopoly of melody. One, at least, of the fraternity recently had his eyes opened to this wealth of musical material, and the result of his discovery is a book of songs about birds in which the melody of each song is made up of themes furnished by the bird to which it relates. Some of these songs are very beautiful.

More remarkable than the union of related phrases in sequence by one bird are those performances, occasionally to be met with, in which two related phrases are sung antiphonally by two separate birds. The meadow larks of the eastern half of the United States (*Sturnella magna*) are especially prone to sing duets of this kind. From forty or more such meadow lark duets that I have noted I here reproduce one sung by two birds on my own place last March:

Were the first bird saying, "I love to sing," and the second rejoining, "So I perceive," the effect of phrase and answer would not be more marked.

From such examples of bird music what are we to conclude as to the meaning of bird song? We find some of the birds uttering musical phrases and sequences of phrases that are governed in their construction by rules that govern the construction of our own musical compositions—that conform to those constructive principles that are developed by musical taste in man. Melody, rhythm, harmony, and tonality combine to make them pleasing to our ears in precisely the same way that human music appeals to us. To account for this phenomenon by a theory of chance coincidence requires a degree of credulity that is immense. That a bird should so combine notes as to produce human music accidentally is as incredible as that it should so combine articulate sounds as to form human speech accidentally. To assume that birds are the unconscious instruments of a higher power made to produce such performances as man alone can appreciate and enjoy, is to return to the long-abandoned attitude under which the stars were regarded as mere points of light, created for the purpose of relieving man of absolute darkness on moonless nights. There remains only the idea that birds sing songs of whose musical beauty they are consciously appreciative. This is the simplest and most plausible interpretation of the matter; and if we are brave enough to disregard that bugbear of the average psychologist, anthropomorphism, we shall understand that birds share with man an intelligent appreciation of music, the difference being one of degree, not of kind. We may not comprehend the full philosophical significance of our own musical emotion, but we may safely rest in the assumption that whatever light we have in this respect equally illumines and makes plain the meaning of bird song.

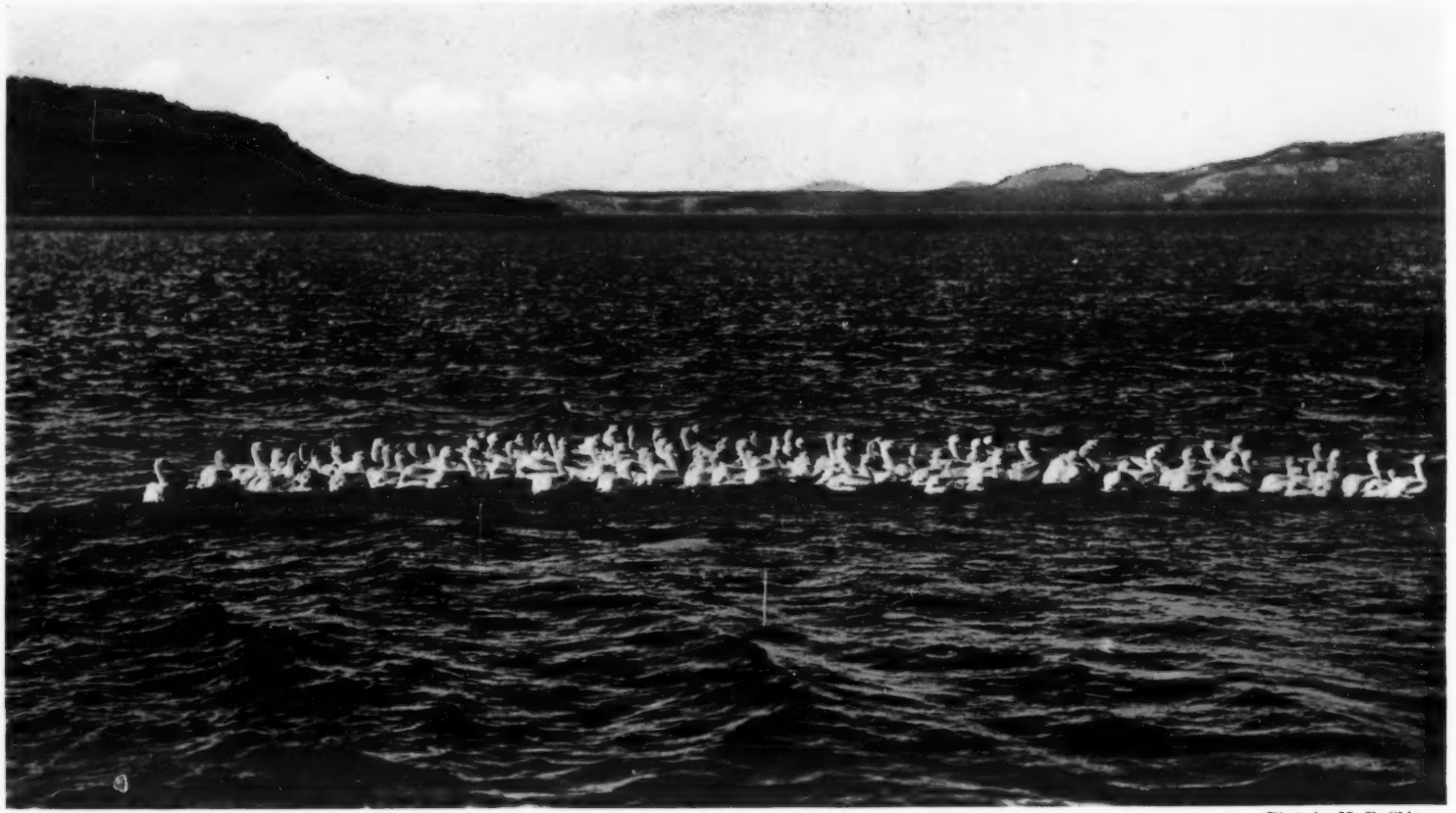


Photo by M. P. Skinner

A SQUADRON OF YOUNG PELICANS ON YELLOWSTONE LAKE

Pelicans, driven westward by advancing civilization, have found a haven on "Molly Island" in the Yellowstone, where they nest in large numbers. They are beautiful as they ride majestically over the water, but they are a sight never to be forgotten when they rise, strong, graceful, and gleaming white, into the blue depths of the sky

Some Birds of the Yellowstone

By M. P. SKINNER

WE often gain a wrong impression as to the number of birds within Yellowstone Park, thinking them few. Heavy timber is seldom found to be very bird-populous anywhere; and, besides, in the parks the heavy timber is where the stage roads are, and the constant travel frightens the birds away. For these are shy birds, not the half-domesticated ones of the farms and villages. Another reason for the conclusion that birds are few lies in the fact that the tourist travels during the heat of the day when the birds are resting. Scarcity, however, is more seeming than real; the birds are there—in large numbers. At present one hundred and ninety-seven species have been recorded. Let the bird-lover go out early and walk along the brush-lined brooks and through the meadows, and he will find birds in plenty. To be sure, there will not be as many as in a cultivated section; there never are. The cultivated area has too many attractions in the way of grains, fruits, and insects.

Usually the first bird noticed in the Yellowstone is one that is small and almost black, flying along close to the surface of a stream. He tries to alight on a slippery rock, slides off into the water, unconcernedly paddles ashore, and climbs out. A close scrutiny shows this oddity to resemble a wren, except that he is darker, and has feet of ordinary passerine construction and not webbed. He is the dainty little "dipper," or "water ouzel," of the mountain streams. If you watch him, he does still more curious stunts. He sits on a stone for a few moments, only his white eyelid moving; then comes to life, bows first toward you, then turns and repeats his curtsy in the opposite direction, walks down the rock into the water, under the water, and across the pool bottom, stopping here and there for a moment, and finally comes shooting up to the surface as buoyant as a cork. No misanthropic hermit is the dipper. True, he lives alone with his family on his own section of stream, which he is always ready to clear of poachers by force of bill and wing, but he picks out the true scenic parts. A waterfall is a favorite dwelling place, and I have never found the nest anywhere but near rapid water. Usually a rock in midstream is selected and the nest placed so that it is directly above the water, the opening downstream. Both birds work hard at building the nest—a ball eight inches in diameter, made of a peculiar kind of moss and fastened in a crevice or notch in the rock with a cement of mud. The ball is lined with mud, and the inner nest constructed of fine, waterproof grass that will not become sodden. The spray from the rushing water keeps the moss green, and during the summer grass seeds are sure to lodge on the ball and sprout there, so that the nest soon resembles a small clod of earth supporting a tuft of luxuriant grasses. The entrance to the nest is usually arched over, or bottle-necked with opening downward, to shed the spray. The brainy little architect waits until after the June freshets before building a nest—which might be inundated earlier. He really seems to wait, for he mates early, after having sung his dainty little song since Christmas. One of the strangest facts in nature is that this tiny bird is a *winter* songster.

He is not just a mere chirper, his notes are varied and unusually sweet. Often he is heard in the depths of a wintry world, when his song rings out above the noise of such rapid waters as are open in January.

Barely has one crossed the northern boundary of Yellowstone Park, before the driver points out Eagle Nest Rock, and the "eagle's" nest on it, but the birds nesting there are actually ospreys. Eagles, both golden and bald, are resident in Yellowstone, build their nests and raise their young there. They are so scarce, however, as to be rarely seen, whereas the ospreys are conspicuous along every large stream. They are found by hundreds about Yellowstone Lake and Cañon. One who has watched and studied the osprey, finds him a far nobler bird than either of the eagles. The golden eagle is a fine bird and usually captures his own prey, but the osprey will touch nothing but fresh fish of his own catching. The bald eagle, unfortunately chosen our national bird, is a robber and a carrion-feeder. He watches the more expert osprey, and when the trout has been secured, he torments the smaller bird until it drops the fish. Then with an exultant scream, the eagle swoops down and catches up his unlawful prey. Often the bald eagle is ignobly caught in a coyote trap set near a dead elk. The osprey is a far different bird, cleanly in his habits—and his young are the models of deportment among birds.

The original nesting site of ospreys in Yellowstone was the tip of a pine or fir, where a great mass of sticks six feet or more in diameter was deposited, at times a stick as large as a man's wrist being used. About Yellowstone Lake there are literally hundreds of these nests. In various other parts of the park, however, notably in the Yellowstone and Gardiner cañons, the osprey has found the pinnacles of out-jutting rock adapted to his purpose, and builds his nest and raises his young there, to the delight of thousands of visitors who can look down upon the family. I cannot confirm other writers in their reports that the ospreys repair their nests in the fall; they may do so. I have repeatedly seen them rebuilding and repairing in April and May, however, when they first return from the South. As a rule the same birds return to a given nest year after year. After the eggs are laid, the mother broods them for four weeks. I do not believe that the male makes it a rule to relieve her, but he does do the hunting and is very conscientious in seeing that she gets her share. Occasionally when the sun is warm, the female gets away from the nest for a short time. The two or three young are hatched so tender that the mother remains on the nest to shield them from the sun with her half-opened wings. When the father brings in a fish, from which he has first removed the head and entrails, there is none of that hurly-burly so characteristic of other birds. The youngsters sit in an orderly row, without any attempt to get the fish, perhaps within three inches of them. The father stands on the trout, tears off half-inch bits which he gives to the mother, she "chews" them a few seconds and then gives some to each nestling in turn. Sometimes the male turns the catch over to the female, letting her do all the tearing and feeding; and he occasionally feeds a bit directly to a youngster. Not only at feeding time do the young ospreys show their training. Let an enemy appear, a warning note is sounded by a parent, usually the mother, and the young instantly throw themselves flat on the

floor of the nest and remain there motionless. Should one be picked up, he is like a lump of putty and can be placed in any posture. Nothing but the parent's cry of "All 's well," perhaps not given until an hour or more after the warning, will bring him back to the semblance of a living bird.

The mountain bluebird is of a beautiful blue, indeed; even the breast is blue instead of the chestnut of the eastern bird. This bird is not quite so domesticated as the better known species, but otherwise is much the same. About the few buildings in the Yellowstone the bluebird nests as fearlessly as about an eastern farm; but buildings are scarce, and many bluebirds still follow their old-time plan of building a nest in the trunk of a quaking asp. It is a pretty sight to see a pair hunting a nesting place in early May. The husband is the scout; he goes ahead and locates a likely tree with an old woodpecker hole in it. Then he brings his wife, no doubt telling her how superior the tree is to all other trees, and the neighborhood to all other neighborhoods, and perhaps calling attention to the running water in the near brook. She hovers for a few minutes in front, looking the opening, the tree, and the neighborhood all over, and when she makes up her mind it is final. Should it be "No," the husband does not sulk but immediately hunts another tree over which he is just as enthusiastic. Should the answer be "Yes," they both set to work to collect materials, but I believe that she places most of it while he cheers her on with his gentle love song. When the bairns arrive, all is hustle and bustle. For a time, I do believe that they are the busiest parents alive. Vast, indeed, is the number of grasshoppers and caterpillars caught to satisfy that hungry nestful.

At the other extreme is the nutcracker, or Clark's crow; nothing soft, nor gentle, nor musical about him! But perhaps our ears are not properly attuned to appreciate the rolling "e-crack-k-k-k" with which he announces his presence. His uniform of gray with flashes of black and white is neat and attractive, and his ready adaptability to conditions should win our respect. This species seems more abundant about Mammoth Hot Springs than anywhere else; presumably the large supply of pine cones, as well as the kitchen scraps, draws the birds there. Sometimes the nutcracker, by a swift, sudden swoop, robs a squirrel of his cone. The squirrel may be knocked from his perch, but even if he keeps his footing he is almost sure to drop the cone. A sudden dive and the nutcracker has it, perhaps before it touches the ground. Now the pine squirrel, himself, is an impudent fellow, a noted thief and robber; but well he knows that the bird can best him. He sneaks back into some protecting cranny and then proceeds to enliven the woods by the vituperation he hurls at his enemy; and that enemy is not slow to give back his unfavorable opinion of squirrels in general, and of that squirrel in particular. I am sure that I should not dare to attempt a translation of those vitriolic remarks.

Impudent rascal and freebooter that he is, the nutcracker is never quite so happy as when a fight is going on. I even suspect him of engineering difficulties for other birds. One day two little mountain bluebirds got into an altercation. They were hard at it, when the nutcrackers began to arrive, screaming. One became so excited that he flew into a wire fence and partially stunned himself. Nor does the nutcracker always confine his attentions to

small birds. Mobbing hawks seems to be a favorite amusement. If the hawk is big and clumsy, so much the better. But it is the breeding habits chiefly that make the nutcracker interesting. February is the height of winter in the Yellowstone, the nights are intensely cold, and the snow still lies deep everywhere. Yet the nutcrackers mate then and build a nest of cedar twigs and such straws as can be found above the snow. Frequently the eggs are laid during the last days of February and brooding begins immediately. I have seen the mother on the nest when the thermometer was below zero, and at other times during a raging blizzard. The young birds are out of the nest and flying about by May first, before most other birds have begun to nest.

It is the Rocky Mountain jay that is beloved of the camper. This bird, known as the "camp robber," although he scavenges rather than robs, is closely related to the nutcracker. He bears a superficial resemblance to that bird, but is smaller, of a gray color without the black and white markings of the other, and his calls are different. The "camp robber" is bold and fearless without the impudent, noisy ways and pugnacious proclivities of the nutcracker. At camp he is always about, always getting into trouble, and always trying to share the camper's good things with him. He claims his share, perhaps because he is socialistic and believes the camper should divide his goods. If the camper is hard-hearted, or even slow, the jay will tell him all about how hungry he is, how scarce food is, how "high the cost of living" is getting, and end his appeal in the most coaxing, wheedling tones imaginable. Hard-hearted, indeed, is he who can resist this daring little beggar. He is into everything, he knows no fear. It is not safe to take a pot or a pan off the fire and set it down to cool—the "camp robber" is watching for just such chances. But he more than makes up for the crumbs and scraps by the companionship he affords.

Perhaps the most astonishing thing about the Yellowstone birds is the friendliness of the ducks and larger waterfowl. It is often hard to believe that the ducks feeding within a few feet of the passing stages are actually "wild." This tameness is not any more peculiar to the Yellowstone, to be sure, than to other absolutely protected places. It is interesting to see how shy the migrating ducks are when they arrive, and how soon they lose their wildness and adopt Yellowstone ways. The mallards are to be found on or near most of the ponds and smaller lakes, usually with a half dozen fuzzy little ducklings following the mother about everywhere. Although the little chaps are expert hiders and dodgers, there is no doubt that the fierce duck hawk and the large owls get a good many. On land they are subject to attack by wolf, coyote, bobcat, and a whole host of smaller fur-bearing animals. Even in the water there is an enemy. I was riding past a pond and noticed a brood of ducklings swimming. They were sunning themselves, and occasionally chasing a venturesome bug across the surface. Apparently they were carefree and safe. Suddenly the mother sounded a note of alarm and made for the farther shore with the whole brood after her. Soon a muskrat appeared swimming rapidly toward the ducks. How they did swim! Not fast enough, although they used their stubby little wings to help them along. The muskrat was almost upon the duckling in the rear, when the mother saw the danger and in an instant was there scooping water with her wings into the rat's

face. This secured delay enough to let the duckling gain a lead. Soon the race was on again and the enemy was getting uncomfortably near. The mother drove him off a second time, and yet a third time, before she had her brood safe on shore.

Some of the big Canada geese stay in Yellowstone Park all winter, finding favorable conditions along the rivers kept open by the hot-spring water. But most of them arrive from the South in early April, and then the ponds and flooded meadows are a riot of noise. The "honk-ah-honk" of geese flying far up overhead is a silvery, musical note; but heard near at hand, especially on a cold, stormy morning when the tired camper is trying to sleep, it arouses other feelings than appreciation of musical quality. Geese are long-lived and are believed to mate for life, yet every spring they become as restless and ardent as any of the courting song birds. After the selection of the nest site, usually the top of a beaver house, a rock surrounded by water, or a low mound of some kind, the birds settle down and give their whole attention to important affairs. There is no nest building beyond lining a slight hollow with a few feathers from the goose's breast. About eight eggs are laid and the goslings appear late in May. It is amusing to see the old goose swimming across a pond with her little ones strung out at regular intervals behind—just as if she were a tugboat towing a string of barges. About four hundred pairs of geese are believed to nest within Yellowstone Park. Like the mallards, the geese become very tame, and are an unfailing source of interest.

I know of no place where protection makes the big hawks as tame and as easily studied as in Yellowstone. Ordinarily hawks are so hunted and harried that the bird-lover must devote considerable time to them before he can say he knows them. Here everything helps the acquaintance. Few of us have much love for the fierce accipitrine hawks, but fortunately these are rare. The western red-tail is the largest hawk, but he does even less damage than his eastern relative, and confines his attentions almost exclusively to gopher and ground squirrel. It is Swainson's hawk that upsets one's preconceived notions of hawks. This species is nearly as large as the red-tail and much more numerous, enough so in the open country to be called abundant. Even the timid little wood warblers have so much confidence in this big rodent catcher that they fly fearlessly all about him and even nest in his immediate neighborhood. Both this hawk and the red-tail vary much in color, from reddish brown to almost black. The marsh hawk is guilty elsewhere of killing small birds; but in the park he too is on his good behavior and devotes his time to mice with an occasional frog or small snake for relish. He is a pretty chap when seen just skimming the brush tops on his way to and fro across the meadows. In places like the Pelican and Hayden valleys, the marsh hawk is astonishingly abundant. It is the little sparrow hawk, however, that attracts the most attention. He does not get up into the elevated sections nor into the timber, but often he is the only animated thing to be seen as we ride through the lower, warmer open country.

In the southeastern part of Yellowstone Lake are two small islets known collectively as "Molly Island." They are low and consist of sand and gravel with only a few bedraggled bushes, but the big white pelicans find them a suitable nesting place. There every summer

about two hundred pairs of these birds lay their eggs and raise their ungainly, unlovely offspring. Molly Island is almost ideal for them; it is secluded in a long, sheltered arm of the lake, yet is far enough from shore to prevent predacious animals from getting to the young birds; also the waters abound in fish, the food of the pelican. In former years, these birds nested as far east as the Dakota lakes, but the steadily advancing civilization has driven them farther and farther west until these little islands are their "farthest East." The pelicans are expert fishermen and their search for prey carries them to all parts of the lake and even down the Yellowstone River below the lake. From the boat that carries passengers across, at least one pelican is invariably seen and the cry "Swan! Swan!" is always raised. This is not so surprising an error, since the birds are large and white, and make very conspicuous objects as they move majestically over the water. In flight pelicans are still more striking in appearance. A single one flying past is a sight to be noted, so white, so large, so strong and graceful. If a small group of them passes, it will be seen that they are flying in line, each pair of black-tipped wings stroking in perfect time with the leader. Then follows a short glide on set wings, which is broken first by the leader, the second bird takes up the stroke, and after an interval as accurate as if timed, the third one joins in. But to see these wonderful flyers at their best, one must go to the southern end of the lake. At certain periods during the day the males relieve their mates on the nest, and then the arriving and departing birds are in squadrons that wheel and maneuver with wonderful precision. To see a flock of a hundred of these great, swift-moving, gleaming-white birds against an intensely blue sky is the sight of a lifetime. It is a picture well calculated to remind us of the wonderful series of birds and animals that has been ours in North America in the recent past; and it can but interest us greatly in the work being done by the United States Government, through the National Parks, in preserving parts of our elsewhere-squandered inheritance.

"Eagle" Nest Rock, a haunt of ospreys in Yellowstone Park

Monoclonius, a Cretaceous Horned Dinosaur

THE FIRST COMPLETE SKELETON OF ITS KIND KNOWN

By BARNUM BROWN

FEW animals have been more discussed than the Ceratopsia, the horned dinosaurs, and none has so stimulated the imagination of the observer to speculate on scenes of prehistoric times. Incomplete skeletons, chiefly skulls, have long been known, yet previous to the American Museum expeditions into Canada several important parts of the anatomy, such as the structure of the feet and length of the tail, remained problematical.

Some of the Ceratopsia were large, others were small, but in all the skull was disproportionately large compared with other dinosaurs of equal bulk. With gigantic head, horns above the eyes and nose, a beak like a turtle's, and double-rooted teeth, they present characters unique among reptiles, living or extinct.

The American Museum expedition of 1914 was fortunate in finding a skeleton of one of the earliest known members of the family, a *Monoclonius*, complete in all details from the tip of the nose to the end of the tail, with most of the bones articulated excepting a part of the feet that had weathered out of the bank. The skeleton was found on Sand Creek, a tributary of the Red Deer River, twelve miles below Steveville, in rocks of the Belly River Cretaceous age, and gives for the first time a knowledge of the complete anatomy of any member of the family Ceratopsia. This skeleton, recently placed on view in the dinosaur hall of the American Museum, has been mounted practically as found, the vertebral column, pelvis, femora and parts of the feet being chiseled out in relief from the original rock. Those parts of the front feet that were scattered have been assembled, after another specimen in which they are preserved in position.

In life this animal was about seventeen feet long from the tip of the tail to the end of the nose, and when standing erect would have measured a little more than six feet in height. It was remarkably short-bodied and walked on all four feet with the front legs bowed outward. On the front feet there were five toes, the three inner ones bearing small hoofs, and on the hind feet four functional toes, each bearing a hoof, and a rudimentary fifth toe.

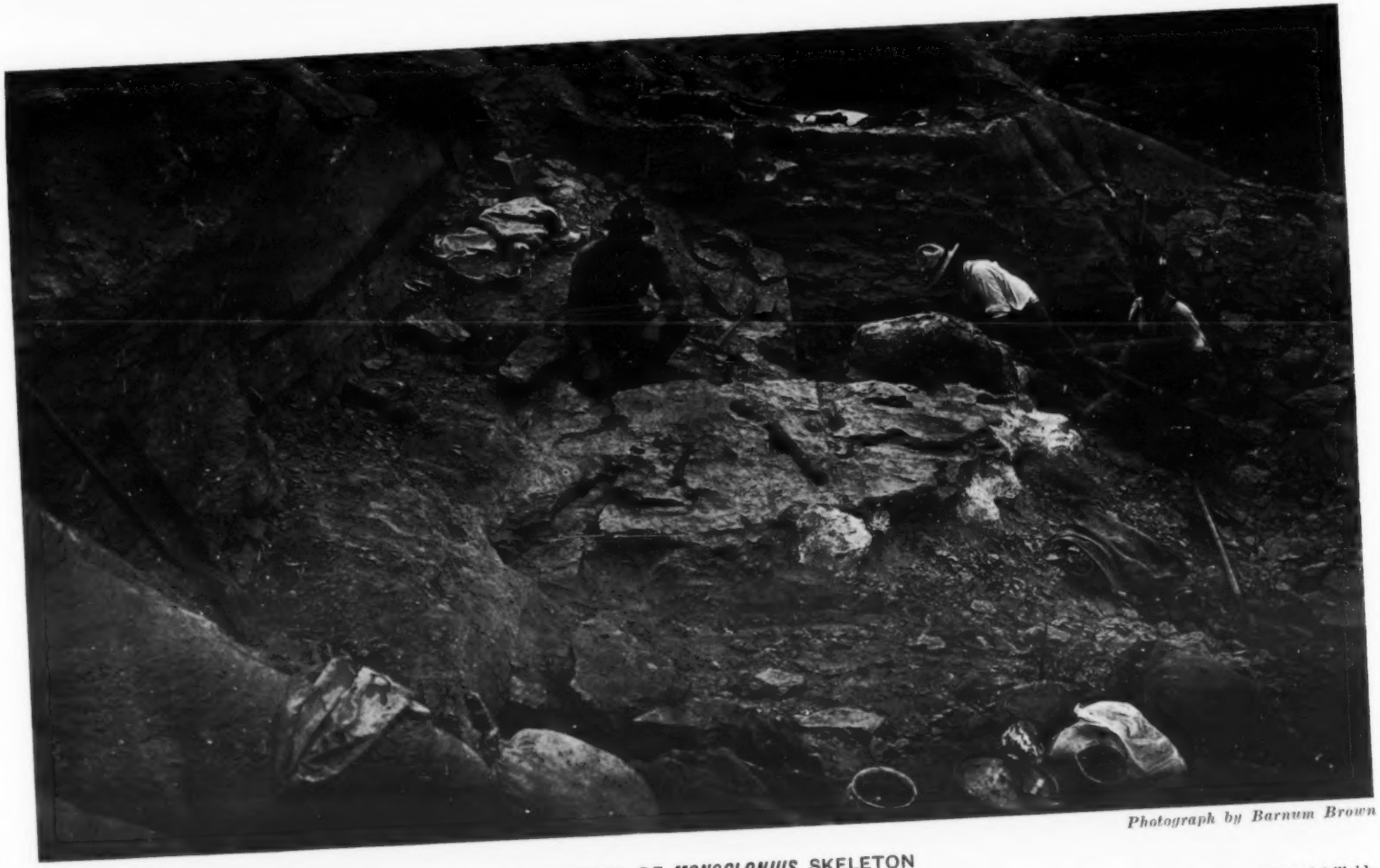
Its most striking feature is the enormous skull, five feet in length, with a scalloped frill extending over the neck, a rhinoceros-like horn above the nose and a rudimentary horn above each eye, and a beak like a turtle's, sheathed in horn and doubtless used for clipping the leafy foliage on which it browsed. Back of the beak there are rows of double-rooted teeth. Its brain of low development was exceedingly small and the comparatively small eye contained a bony ring of plates like those of an owl, which were doubtless a development for the adjustment of light, probably enabling the animal to see at night as clearly as in the day. The tail, though fairly long, was weakly developed and did not function as a balancing or propelling organ. Above the pelvis a series of bony rods is preserved, the contracted portions of some of the stronger back muscles.

In another specimen of *Monoclonius* a part of the epidermis impression is preserved and we now know that the

Photograph by Barnum Brown

A TREASURE GROUND OF DINOSAURS

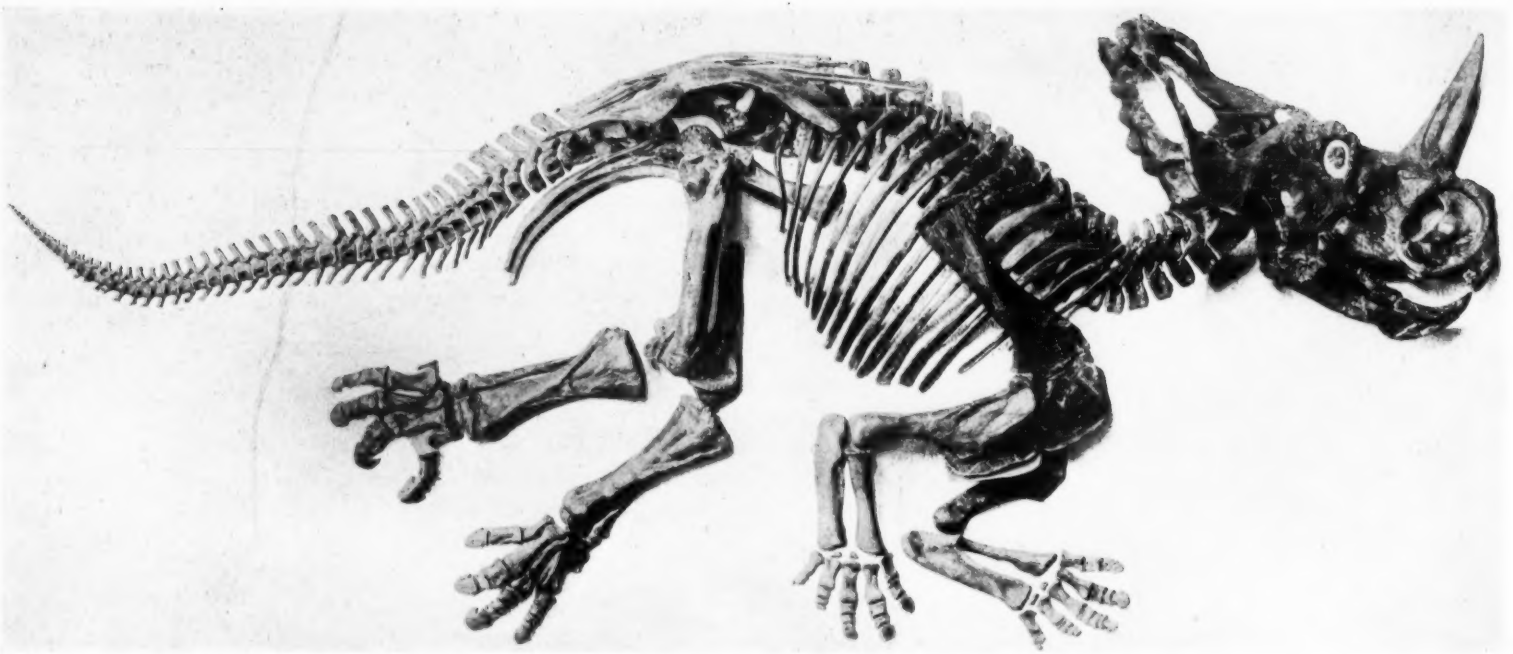
No area of equal dimensions has yielded so many well-preserved specimens or such varied forms of dinosaur life as the banks of the Red Deer River and its tributaries in Alberta. When these rocks were deposited, conditions were here most favorable for the preservation of animal remains. Now fields of yellow grain cover the level prairies above and beyond. Rainstorms are infrequent but torrential in this section, and rivulets plunging down to the river three hundred feet below have long rioted through the underlying soft clays and sands, winding, cutting, and ever exposing countless fossil treasures. Four dinosaur skeletons, many skulls and incomplete skeletons, turtles, and plants were collected from this small area on Sand Creek



Photograph by Barnum Brown

EXCAVATION OF *MONOCLONIUS* SKELETON

The complete *Monoclonius* skeleton uncovered ready for plaster jackets; patches of plaster are seen covering the foot bones that were exposed on the original hillside when the specimen was discovered



MONOCLONIUS SKELETON RECENTLY EXHIBITED IN THE AMERICAN MUSEUM

The vertebral column and most of the other bones were in position; they have been chiseled out in relief and the scattered parts have been assembled after another specimen in which they were articulated

A CRETACEOUS SUBTROPICAL GLADE IN ALBERTA, CANADA

Palms, fig trees, sequoias, and plane trees formed the "sylvannas" of those early days. Knee-deep in grasses, *Monoclonius* peacefully browsed, his only concern the giant flesh eaters. Restoration made by Richard Deckert under the supervision of the Author

skin of the horned dinosaurs, like that of some modern lizards and of the duck-billed dinosaurs, consisted of low polygonal tubercles surrounding widely separated, large, low, round tubercles. Above the backbone, especially in the tail region, there was probably a row of small plates, one above each vertebra.

The horned dinosaurs lived during the close of the Cretaceous period and their remains are found from Texas northward to southern Alberta. Several genera are distinguished, chiefly by characters of the skull which in all forms was disproportionately large. In some genera like the present *Monoclonius* the nasal horn was long and the horns above the eyes were short, while in the last and largest of the race, *Triceratops,* the nasal horn was short and the orbital horns extremely long. In the genus *Styracosaurus,* also from the Belly River rocks of Alberta, there was a long nasal horn, and in addition longer bristling spikes that radiated from the border of the frill like a crown similar to the spikes on the modern lizard *Phrynosoma,* popularly known as the "horned toad."

Some writers have argued that the horns were offensive and defensive weapons, as on occasion they may well have been. A great variety of horn development, however, is displayed in different genera of similar habits, and the horns and skull excrescences were doubtless to a large extent ornamental, as they are in many living lizards.

The horned dinosaurs were huge bulky creatures and were probably sluggish of habit, but the living animal weighed much less than a mammal of equal size. The skeleton, petrified, is very heavy, whereas in life it was light, for the bones are composed of highly cellular tissue, while in the fossil state the cavities are filled with silicates.

These animals were land-living, vegetable-feeding reptiles that lived along the marshes of a sea which at that time washed the eastern slope of the Rocky Mountains. Their extinction was not due to any great cataclysm nor on account of any sudden change in temperature, for many plants that were contemporaneous with them persisted over the general region long after the dinosaurs disappeared. As the mountains were elevated this sea gradually drained, cutting off their particular kind of food, and as they were not migratory creatures, the final disappearance of the sea marked the end of the dinosaurs in any given locality.

Fossil Man in South Africa

A LETTER FROM DR. ROBERT BROOM

FRIENDS of the Museum will recall with pleasure the visit of Dr. Robert Broom, the well-known South African palæontologist, two years ago. Dr. Broom's stay resulted in the acquisition by the Museum of his splendid collection of fossil reptiles from the Permian of South Africa, and in a series of valuable researches upon these and other fossil vertebrates. The outbreak of the great war found him on his way back home, but he promptly enlisted, served for a term in his professional capacity as army surgeon, and has since returned to South Africa. His continued interest in the Museum and appreciation of its work and ideals are shown in the following announcement of an important new discovery:

PORT ELIZABETH, SOUTH AFRICA
November 12, 1916.

MY DEAR PROFESSOR OSBORN:

Knowing how interested you are in primitive man, I thought you would be pleased to have an early account of what is, with the exception of the Piltdown skull, the most interesting early skull known.

In 1913 a farmer digging a trench through surface laterite on his farm at Boskop near Potchefstroom, Transvaal, discovered much of the skull and some fragmentary remains of a human skeleton. The remains are now in the Port Elizabeth Museum. A preliminary note has been made on the remains by Mr. S. H. Haughton, of Cape Town, and his view is endorsed by Dr. L. Péringuey, of Cape Town—that the remains are those of an early type of modern man most nearly allied to the Crô-Magnon type and perhaps ancestral to existing African types.

The skull is represented by the nearly perfect frontals and parietals with part of the occipital, the nearly perfect right temporal, and the greater part of the horizontal ramus of the left mandible. The skull is of great length. The calvarium as preserved measures 205 mm. and the greatest length was probably originally about 210 mm. The bones are extremely thick. The parietals in the region of the eminences measure 13–15 mm. and the frontals 12 mm. The cranium is quite unlike that of the Neanderthal type in having a well-marked, low, but not retreating brow, and very feebly developed supra-orbital ridges—not much larger than in most Kaffirs. Notwithstanding the thickness of the skull, the brain is enormous. The restored brain cast indicates that the cranial capacity was about 1960 c.c.

The lower jaw has lost, unfortunately, all teeth except the roots of the second molar, but the socket of the canine is fairly well preserved, and there is to my mind no doubt that the canine was about as large as in the jaw which I still believe belongs to the Piltdown skull. The incisors must also have been very much larger than in any modern man. The transverse measurement across the two canines cannot by any possibility have been less than 40 mm. and was probably 44 mm. A large Kaffir jaw on my table has a corresponding measurement of only 32 mm.

In a paper I have just sent to the Zoölogical Society, London, I have regarded the Boskop skull as the type of a new species of man, *Homo capensis*. I regard it as intermediate between the "dawn man," *Eoanthropus dawsoni*, and the early African type of man as represented by the Crô-Magnon man and the ancestral negroid type. The Australian native is regarded as possibly also derived from a similar early type, and perhaps even the Neanderthal man, whom I regard as not a primitive but a highly specialized type. *Homo capensis* has very small frontal sinuses and supra-orbital ridges. *Homo neanderthalensis* differs but little except in having the modern type of dentition and in having the ridges and sinuses greatly developed.

The skull is completely fossilized—every cavity of the bone being filled by laterite. These surface laterites have long been known to be of great age, but exactly how old we cannot say. In our surface deposits we have also long known a great abundance of huge *bouchers* [skinning knives] of Chellean or Acheulean types, but hitherto we have never obtained any human remains. In a gravel deposit in the Kimberley district *bouchers*

of the same type have been found associated with mastodon teeth. Whether, however, the maker of the *boucher* was contemporaneous with the mastodon, as I am inclined to believe, or the mastodon tooth washed into the gravel deposit from an earlier bed, may be regarded as an open question.

The probabilities seem to be that while the mastodon was still alive in South Africa we had large numbers of some pre-Bushman race whose only remains hitherto known have been the thousands of *bouchers*, sometimes of huge size, scattered over most of the country. The Boskop man is probably a member of this race, and perhaps of the same race as made the Acheulean implements so well known in Europe.

Ever yours sincerely,
[Signed] R. BROOM.

The significance of the (indirect) association of the Boskop skull with the mastodon may not be apparent to American readers. In this country the mastodon is best known from the Pleistocene, the age of man, and survived to recent time, after the last of the great ice sheets had disappeared. Man contemporary with mastodon would not here imply any great antiquity, geologically speaking.

In the Old World, however, the mastodons all disappeared much earlier, and the latest of the Old World mastodons, unless these Kimberley specimens be an exception, are found in the Upper Pliocene epoch, older than any fossil human remains yet discovered.

If therefore the Boskop skull was really contemporaneous with mastodons in South Africa, it means either that the mastodon survived much later there than in Europe or Asia, or that the skull, typically human though it be, is of Pliocene age. In view of so important a possible conclusion, the guarded terms in which Dr. Broom describes the circumstances and character of the find should be very carefully studied.

W. D. M.

The Great Jade Mass from Jordansmühl

The largest piece of jade ever found in situ and the largest ever polished, measuring seven feet long by two and one half wide, and weighing 4718 pounds (2140 kilograms)

THE great mass of jade (nephrite), whose polished green surface now gives a note of color to the somber circle of meteorites in Memorial Hall at the American Museum of Natural History, is unique among the mineral collections of this or other museums, intrinsically and because of its bearing on a disputed ethnological question. The mass, which weighs between two and three tons, presents the most extensive surface of jade that has ever been polished, and is the largest piece of jade ever found *in situ*, though its weight is not as great as that of a waterworn specimen from New Zealand, weighing three and one half tons, on exhibition in the South Sea Islands hall of the Museum.

While preparing the catalogue of the large collection of jade and jadeite of the late Heber R. Bishop, the writer noted that it contained no specimen with the matrix attached; further inquiry revealed that the same was true of the collections of all European and American museums. When abroad in 1899 to obtain such a specimen, I visited Jordansmühl, southwest of Breslau in Silesia, where small specimens of jade had been found by Dr. Traube in 1884. Through the courtesy of Dr. C. F. Hintze, professor of mineralogy in the University of Breslau, I was enabled to locate the quarry of Jordansmühl, get the permission of the owner to visit it, and use to the best advantage the single day at my disposal for the search.

Although Dr. Hintze was skeptical about the possibility of securing a large specimen in so short a time, an examination of the quarry at once gave evidences of nephrite. In a bowl-shaped hill of serpentine, about seventy-five feet high and two thousand feet long, several protuberances were noted. Most of these were *weisstein*, but one, greenish in color, proved upon investigation to be nephrite, or jade. The dimensions of

Quarry at Jordansmühl, Silesia, where the largest block of jade ever mined was discovered in 1899. Although people familiar with Jordansmühl were skeptical as to the chances of obtaining jade specimens of note in a spot where quarrying had been going on since Roman times, a search of less than a day was rewarded by the discovery of a jade block weighing between two and three tons. The cross indicates the original position of the mass

A near view of the original resting place of the jade block of Jordansmühl, now exhibited in Memorial Hall of the American Museum of Natural History. To the left is seen Dr. Carl Hintze, of the University of Breslau, Germany, through whose courtesy was made possible the acquiring of this remarkable specimen

this mass were seven feet in length, two and one half in breadth, and one foot in thickness. The strictness of the German regulations made dynamiting out of the question, but by means of a lever drill—a heavy crowbar embedded in a log twelve feet long and six inches in diameter—wielded by a dozen men, the great mass was loosened from its position. Dr. Hintze, who had the right to claim one half of what was found, kindly made arrangements to allow me to transport to America the whole of the giant mass.

There is ethnological significance in this great mass of jade, which had so curiously remained unnoticed in a hill where quarrying has been going on since the time of the Romans. Dr. Heinrich Fischer, of the University of Freiburg in Baden, who devoted his life to the study of jade (*Die Nephritfrage*), concluded from a consideration of race migration that all the jade objects found in Europe had an Asiatic origin. Professor A. B. Meyer, director of the Royal Anthropological Museum at Dresden, regarded the presence of jade in Europe as a chemical problem, not an ethnological one, although his views were assailed by the leading scientists of his day. Dr. Meyer's opinions have been reënforced by the finding in Germany of this great mass of nephrite, sufficient in itself to furnish material for all the jade objects and ornaments yet found in Europe. There is now no reason to believe that prehistoric jades need, necessarily, to have been brought to Europe in race migrations from the Orient.

Tiffany and Company, of New York City, did the polishing of this great mass—a triumph, owing to the extreme toughness of jade.

GEORGE F. KUNZ.

Report from the Asiatic Zoölogical Expedition

THE Asiatic Zoölogical Expedition of the American Museum of Natural History was organized early in 1916, and placed under the leadership of Mr. Roy C. Andrews, assistant curator of mammals in this institution, for the purpose of collecting zoölogical and ethnological material in southeastern China, particular attention being given to the mammals and birds. The expedition has been financed in part by a fund made up of contributions from Mr. and Mrs. Charles L. Bernheimer, Mr. George T. Bowdoin, Mr. and Mrs. Sidney M. Colgate, Mr. Lincoln Ellsworth, Mr. James B. Ford, Mr. Childs Frick, Mr. Henry Frick, and Mrs. Adrian Hoffman Joline, and in part by the Jesup Fund of the American Museum.

Mr. Andrews, accompanied by his wife, who is the official photographer of the expedition, sailed from San Francisco March 28, 1916, and after spending about three weeks in Japan making colored and motion pictures, proceeded to Peking, arriving there early in May. From Peking they went by rail to Foochow, the port of Fukien Province, the region where the first real collecting was to begin.

One of the special objects of the expedition was to secure, if possible, specimens of the so-called "blue tiger." Mr. Andrews was fortunate in making the acquaintance of the Rev. Harry R. Caldwell, a missionary, who, having seen two of these animals during his residence in that region, was the first to give authentic reports of the presence of this species of tiger. From latest information received, the expedition has been unable to secure any specimens of the animal. They report that upon two occasions they had the blue tiger almost within reach, but that he could not be induced to come out into view from the grass, which would have given an opportunity for a shot. During their stay in this province, however, they secured about three hundred and fifty birds and one hundred and fifty mammals, which have already been received at the Museum.

In view of the difficult conditions under which the expedition had to labor—a temperature registering about 150° F. at midday and 95° F. in the evening, with a humidity of approximately 95—the results are highly satisfactory. Among the specimens secured were a number of interesting mammals, including two species of muntjac, two remarkable raccoon dogs, several wild cats (not yet identified), and six species of bats

belonging to at least five genera. The success of the expedition in obtaining this fine series of mammals is largely due to the assistance and coöperation of two men familiar with the region, the Rev. H. R. Caldwell and Professor C. R. Keller.

On July 20, 1916, Mr. Andrews' party was joined at Fu-tsing by Mr. Edmund Heller, an American collector of wide experience in securing and preserving mammals and birds in tropical countries. After a further stay of a few weeks in this locality, the party returned to Foochow and proceeded by boat to Hanoi, Tongking, China, and thence by rail to Yunnanfu, the capital of Yunnan Province, which was made the headquarters of the expedition. Here the party engaged and outfitted thirty-three mules, and started for Talifu, which was reached by fourteen days of steady riding. After resting at Talifu for a few days, they engaged a new caravan and proceeded to Li-Chiang, a five days' journey distant, where they began collecting. They expected to stay along the edge of Tibet in Yunnan until about December first, going as far north as Atumtyu and then returning to Talifu.

While on their journey to Yunnanfu, through a region notorious for bandits, they were fearful of trouble but passed unmolested. On the ninth day out, however, while they were riding along in a deep pass, a boy came running down the trail to inform them that his caravan, which was not far in advance, had been attacked by robbers. Mr. Andrews and Mr. Heller scouted ahead, found the caravan which had been attacked, and ascertained that no one had been killed, although the packs had been thoroughly ransacked and the bandits, about forty in number, had made off with a good supply of jade, musk, and gold dust.

While in the vicinity of Li-Chiang, the expedition worked for seven weeks on the slopes of a mountain eighteen thousand feet high, and during that time collected more than eleven hundred mammals, which indicates the richness of the fauna. Among other specimens they secured five gorals (*Nemorrhædus*) of both sexes and of different ages, also four serows (*Capricornis*). Both of these animals are exceedingly rare and difficult to secure, and Mr. Andrews writes that they have obtained what is without doubt the finest series ever taken from one place in Asia. A large percentage of the mammals secured here will undoubtedly prove new to science, since no zoölogist has previously visited this region. Mr. Andrews, in one of his recent letters, writes that this particular region is essentially Tibetan, that there are very few Chinese, and the people belong to the original tribes (Mosso, Lolo, and Shaus), while two days' travel north of Li-Chiang there are only Tibetans—consequently ethnological work was of interest.

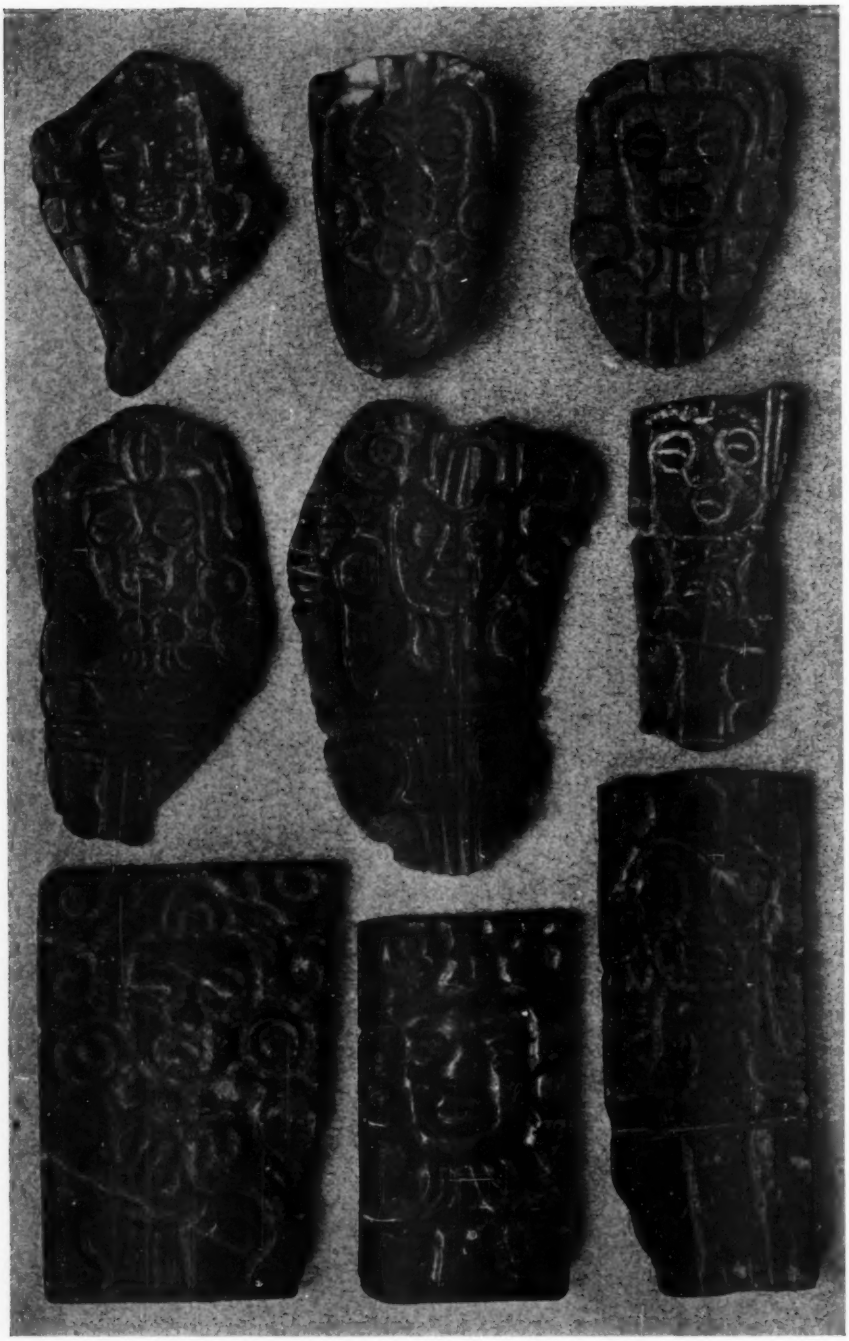
When the expedition left New York, the plan was that it should return in June, 1917. Through contributions from some of the patrons who first financed the organization, it has been made possible to grant an extension of time. The expedition, therefore, will probably not reach New York until about October of the present year.

Since the foregoing was put into type, we have received a letter from Mr. Andrews, headed Talifu, January 10, 1917, in which he says:

"We have returned from our northern trip along the Tibetan border and have over thirteen hundred specimens to show for it. We were somewhat disappointed in the large game, for we found no hunting grounds equal to those of Li-chiang, where we got the fine series of gorals and serows. We found small mammals abundant, and we believe we have a lot of things which will prove new to science. We went as far north as we could, to Hsias-chientien, and then the snow and cold drove us out. . . . We went westward then to the Mekong River, only one day's trip from the edge of Burma, and back to this place. The trip consumed three months and we now have a splendid idea of the country and its fauna along the edge of Tibet.

"We are at present preparing for a trip southward into tropical country. . . . We plan to go straight south for about fifteen days' travel and will then be at the edge of Burma. We shall work the Burma frontier and swing around northward, ending our field work at Teng-yue. . . .

Yunnan is by far the most interesting province of China, zoölogically, for its faunal range is very great. . . . We did not get a large quantity of big game, for it is not here; nevertheless, we have a good representation of what is here, and because of its rarity, it is especially interesting and valuable." J. A. ALLEN.



JADE ORNAMENTS FROM OAXACA, SOUTHERN MEXICO

The chief beauty of these stones, recently acquired by the American Museum, lies in their exquisite coloring—which unfortunately cannot be reproduced in a photograph. The designs represent human figures with enlarged heads, the limbs being warped to fill the irregularities of the stone. See note on page 147

Museum Notes

SINCE the last issue of the JOURNAL, the following persons have become members of the Museum:

Patron, MRS. WILLARD STRAIGHT.

Life Members, MRS. DELOS O. WICKHAM, and MESSRS. WM. REYNOLDS BROWN, HENRY L. DOHERTY, BRUCE FORD, E. H. R. GREEN, H. M. HANNA, JR., W. P. HARDENBERGH, EDWIN KUTTROFF, W. H. MARSHALL, WM. H. NICHOLS, E. W. RICE, JR., ARCHIBALD T. SCOFIELD, EDW. R. STETTINIUS, and SAMUEL M. VAUCLAIN.

Sustaining Member, MR. C. H. ZEHNDER.

Annual Members, MRS. FREDERICK H. EATON, MRS. LOUIS FITZGERALD, MRS. MAUDE KISSAM, MRS. GEO. LAUDER, JR., MISSES A. V. ACKER, THORA RONALDS, and ANNETTE YOUNG, GENERAL JOHN PITMAN, United States Army, COLONEL DAVID L. BRAINARD, United States Army, DR. E. H. ARNOLD, DR. JAMES C. AYER, DR. FRANK ERDWURM, and MESSRS. FRANK ALTSCHUL, W. I. BABCOCK, GEORGE V. N. BALDWIN, JR., PAUL J. BAUMGARTEN, ROBERT C. BIRKHAHN, HENRY BLOCK, ALBERT BLUM, ERNEST CLIVE BROWN, EDWIN G. BRUNS, JR., WILLIAM J. BURNS, GEORGE H. BURR, CHARLES E. BUSHNELL, EDWARD T. CALDWELL, HERBERT J. CARR, JOHN J. CARTY, J. HERBERT CASE, A. WAYNE CLARK, WM. EDWARD COFFIN, MARTIN CONBOY, H. C. CORSON, GEORGE D. CROSS, JOHN V. N. DORR, LEONARD H. DYER, ERNEST ELLINGER, FRANKLIN FORD, W. W. FRAZIER, ABRAHAM A. HELLER, VICTOR HERBERT, CHAS. H. HERTY, HARVEY LEWIS HOOKE, EDWIN J. KEANE, F. J. LE MAISTRE, FRITZ LINDENMEYR, E. C. LUFKIN, NELSON B. MAYER, T. E. MITTEN, EWALD MOMMER, CHARLES S. MONTGOMERY, WILLIAM J. PALMER, BERNARD E. POLLAK, DAVID PRICE, LOUIS RIEGEL, EDWARD G. RIGGS, JOSEPH RUNSHEIM, RAYMOND M. SCHRENKEISEN, HERBERT SCOVILLE, JOHN SLOANE, AUGUSTUS SMITH, ELMER A. SPERRY, C. W. STOWELL, DUNCAN D. SUTPHEN, W. E. SYMONS, ALFONSO P. VILLA, FRANCIS RAWLE WADLEIGH, ELLIS D. WILLIAMS, and WALTER H. WILSON, and the ETHICAL CULTURE SCHOOL.

FOR their generous gifts and continued cooperation in the work of the American Museum, the following have been elected to higher degrees of membership:

Associate Founder, MR. A. D. JUILLIARD.

Associate Benefactors, MESSRS. FREDERICK F. BREWSTER, JAMES B. FORD, HENRY C. FRICK, and ADRIAN ISELIN, JR.

Patrons, MRS. PAUL J. SACHS, and MESSRS. HENRY P. DAVISON and PAUL J. SACHS.

Fellows, MESSRS. CHARLES L. BERNHEIMER and B. PRESTON CLARK.

AN interesting series of slabs of carved jade, together with other semiprecious stones from the state of Oaxaca in southern Mexico, has recently been acquired by the American Museum. The slabs of jade are perforated for suspension and were probably used as breast ornaments by persons of rank. They were cut from stream-worn pebbles, by a tedious process, using sand and water and a cord, and were afterward carved by the same general method, the circle being made by means of hollow canes, and the lines by means of a pointed stick and sand. The designs in most cases represent entire human figures with greatly enlarged heads and with limbs warped to fill out the irregularities of the slab. Headdresses of animals are worn by the figures in some instances, but are so conventionalized that only the eyes and teeth can be made out. The chief beauty of the carvings consists, however, not in the design, but in the exquisite coloring of the stones.

The town of Tuxtepec, from which the specimens come, is a region now occupied by the Chinanteca Indians, and the carvings resemble those found at the famous ruin of Monte Alban, which occupies the great hill overlooking the city of Oaxaca and represents one of the earlier civilizations of the Mexican highlands. The fact that most of these tablets show weathered surfaces gives some indication of the geological conditions under which the jade occurs. As yet jade has not been found *in situ* in this region, and it has been a mystery to many persons where the material was obtained by the Indians in such quantity. Examination of the Aztecan documents discloses the fact that jade and other precious stones, called by the Aztecs *"chalchihuitl,"* were demanded as a tribute from certain vassal towns in southern Mexico. This fact seems to localize the occurrence of jade and to offer hints to the mineralogist. Carved stones of this type

were used in later times in Mexico, but the style of art is different. Jade is so precious, however, that these objects probably outlasted all others and were passed down, so that even in later times stones representing earlier grades of civilization still existed. In view of the Museum's extensive exploration in southern Mexico in former years, this acquisition of a series of the rarer art objects from the same district is especially valuable.

AT the annual meeting of the trustees of the American Museum of Natural History, held February 5 at the home of Henry C. Frick, the board of officers was reëlected for the ensuing year—namely, President, Henry Fairfield Osborn; First Vice-President, Cleveland H. Dodge; Second Vice-President, J. P. Morgan; Treasurer, Henry P. Davison; Secretary, Adrian Iselin, Jr.; Trustees for the class of 1921, Charles Lanier, Anson W. Hard, Frederick F. Brewster, and R. Fulton Cutting. The trustees adopted the largest budget in the history of the institution, and discussed plans for the extension of the usefulness of the Museum to industry, art, and civic life in view of the deprivations in these lines due to the European war.

IT has been found that the most interesting specimens in the fish collections brought back by the Congo Expedition are the catfishes (Siluridæ). Messrs. John T. Nichols and Ludlow Griscom have just completed the classification of representatives of this group and find sixty-three species, including eight species and four genera new to science. The new forms will later appear described and figured in the *Bulletin* of the American Museum.

TWO new acquisitions in the hall of public health are models showing methods of control of certain insect-borne diseases in Africa. The ticks which carry African tick fever, or relapsing fever, are destroyed by the very effective means of burning down the native huts which they have infested. The tsetse fly, carrier of sleeping sickness, lives along the shaded banks of the rivers, and one of the models shows men at work clearing these areas. The models were made from pictures taken by Mr. Herbert Lang in the Belgian Congo.

AMONG recent acquisitions the Library is glad to acknowledge three works of moment both for subject matter and for their place in the history of their peculiar branch of science. The first is a two-volume folio set: Buc'hoz, P. J., *Première(-Seconde) Centurie de Planches . . . représentant au naturel ce qui se trouve de plus intéressant et de plus curieux parmi les Animaux, les Végétaux, et les Minéraux.* Paris, (1775), 1773–1781. "Intéressant et curieux" the volumes certainly are, and while any one trained in present day realism might smile with a bit of superiority over the "naturel," a continued perusal will cause him to grant the naïve and comprehensive claims of the title page. The second acquisition, *Der Organismus der Infusionstiere,* Leipzig, 1859–1883, is by Dr. Friedrich Stein, a pupil of Johannes Müller, founder of the modern school of biology in Germany. This monograph has long been needed by the Museum library. The third acquisition, *The Birds of California,* by William Leon Dawson, comes through the courtesy of Professor Henry Fairfield Osborn. The prospectus of this work promises that it will be a comprehensive bird book of great working value.

A MONOGRAPH on the Rhynchophora, or weevils, of northeastern America by Messrs. Charles W. Leng and W. S. Blatchley, has recently been published. Not only has a comprehensive treatment of these important insects been needed for some time, but this work is more than ordinarily useful because the authors have succeeded, by means of keys based on easily observed characters, in making it available to those not already well acquainted with the group.

THE entomological department of the Museum receives every year a large number of letters from insect collectors inspired by the erroneous idea that the collection and sale of butterflies and moths is a very profitable undertaking. This idea generally owes its origin to the publication of fictitious stories in periodicals or newspapers about persons who have made money in this way, and the writers ask for pamphlets or information on the "business of butterflies" and the "butterfly markets." In order adequately to deal with this considerable correspondence a circular has been prepared by the department to be sent to inquirers.

THERE has been published by the Museum a four-page leaflet by Dr. Frank E. Lutz

giving an outline of the plan of the hall of insect life, and designed not only to give information about insects and the biological problems which they illustrate, but also to interest the visitor in the subject of entomology. The exhibits have been arranged as far as possible to tell a connected story. Some of the headings of the series are "The Importance of Insects," "What is an Insect," "Ontogeny, Anatomy, and Physiology," "Taxonomy," "Phylogeny," "The Four Ages and the Seasons," "Insect Associations," "Enemies of Insects," "Evolution," and "Social Insects."

THE Museum has purchased from Mr. E. L. Troxell a massive mastodon skeleton from the Pliocene of Texas. It is unfortunately incomplete; the hind limbs are missing, and of the skull there are preserved only the lower jaws, one upper tusk, and a few fragments. It is finely preserved, however, and represents a remarkable race of Tertiary mastodons which seems to have reached its climax in North America. It is distinguished especially by the immense length of the jaw, by the bulky body, and very short legs. In this specimen the body and fore legs are as bulky as those of the great Warren mastodon, but the fore limb bones are only about three quarters as long; the hind feet and presumably the hind limbs are smaller, while the lower jaw exceeds six feet in length, more than twice as long as in the Warren mastodon. Its geological age is much greater.

THE Museum has received an important Alaskan Eskimo collection from Lieutenant George T. Emmons, one of the most distinguished anthropological collectors in America, noted for the precision and accuracy of his field notes. The collection comes from the mouth of the Kuskokwim River and northward. This is a region hitherto not well represented in the Museum's collections, but with this acquisition there is now a good study collection for the whole stretch of Alaskan coast. The material covers all phases of Eskimo culture that can be represented in a collection, but is particularly strong on hunting and industrial objects. Altogether the collection contains about seven hundred and fifty pieces.

IN recognition of his services to the American Museum in scientific research and in the painting of South American birds, the trustees of the Museum elected Louis Agassiz Fuertes a Life Member at the annual meeting on February 5.

THE second annual meeting of the American Society of Ichthyologists and Herpetologists, which was organized at the American Museum of Natural History a year ago, was held at Philadelphia, March 8. The Museum was represented on the program by the following papers: "On the Fishes of the American Museum Congo Expedition," John T. Nichols; "Illustrations of Fish in Mediæval Manuscripts and Early Printed Books," Charles R. Eastman; "A Reconstruction of the Musculature of the Permian Reptile Cynognathus," Charles L. Camp; "On Certain Congo Reptiles," Herbert Lang; and "Notes on the Types of West African Species of Lizards described by Dr. Edward Hallowell," Karl P. Schmidt.

MR. W. DE WITT MILLER, assistant curator of ornithology in the American Museum, started February 18, via New Orleans, Colon, and Costa Rica, for Nicaragua, where he will spend three months or more in making ornithological collections. Mr. Miller's perfect acquaintance with the Museum's series of tropical birds will enable him to fill gaps in the collection. He is to bring back not only bird skins, but also alcoholic specimens, together with data on nests and feeding habits of birds, studies of faunal zones, and other matters frequently neglected by collectors, but invaluable for an adequate understanding of the specimens. Mr. Miller is accompanied by Mr. Ludlow Griscom, who, although going on a private venture, will nevertheless collect for the Museum. In Nicaragua Mr. Miller and Mr. Griscom will meet Mr. William B. Richardson, of Matagalpa, who has done much collecting for the Museum, and whose advice and experience will be invaluable.

MR. FRANK W. KITCHING has contributed to the general endowment of the American Museum, shares of stock of the Anaconda Mining Company valued at more than $10,000, the income of which is to be devoted to general museum purposes. In recognition of his generosity, the trustees of the institution at their annual meeting elected Mr. Kitching an Associate Benefactor of the Museum.

THE department of anthropology has recently received as a gift from Mrs. Wm. Tod Helmuth a sacred belt, apron, and headdress from Darjeeling, Tibet. They are made of shuttle-shaped pieces of human bone, ornately carved and strung together with smaller bead-shaped bits of bone, against a background of green cloth. The Tibetan wearer believes that the garments have the power of transmitting to him the virtues of the saints of whose bones they are made. In recognition of this gift, Mrs. Helmuth has been elected a Patron of the American Museum.

MR. ALESSANDRO FABBRI has been appointed research associate in physiology in the department of anatomy and physiology of the American Museum. Mr. Fabbri, who has gained fame for his marvelous work in the production of motion picture films of microscopic forms, is at present devoting himself to making motion photographs of isolated living cells in which it is intended to show, in a graphic way, contractility and like phenomena. Mr. Fabbri will present to the Museum copies of the films he makes.

THE first exhibition of prizma motion pictures, given at the American Museum of Natural History on February 8, called forth more than three thousand spectators, so many that to accommodate an overflow of fully a thousand people the films were run through a second time. The prizma pictures furnish a most remarkable reproduction of the colors of nature. Four colors, made up of two pairs of complementary colors, and covering photographically the whole range of visible colors, are made use of to give a roundness and depth to the pictures which could never be attained in black and white. The pictures are taken on standard panchromatic film, and, although in the hand they have the appearance of the black and white films in general use, they possess color values which are reproduced by special attachments applicable to standard projecting machines.

THE American Museum has acquired by purchase the complete fall of the new meteorite known as Burkett. It is in six pieces and weighs 8,018 grams. The specimen was found by Mr. W. A. Smith, October, 1913, on the premises of his father-in-law, Mr. D. W. Howe, in Coleman County, Texas, about eighteen and a half miles northeast of Coleman City on the waters of Pecan Bayou known as Section 24, surveyed by the Houston, Texas, and Brazos River Railroad, and patented by D. W. Howe. The Holloway Peaks bear east about three miles, and the town of Burkett bears north about three and a half miles, latitude thirty-two degrees north and longitude one hundred degrees west from Greenwich. The mass was partially buried with the large end down, dipping toward the east at an angle of about twenty degrees. It was found on level ground. The soils of this area are sandy loam and gravelly loam types, interspersed with belts of black soil. These soils seem to be of residual origin, the sands, sandy loams, and gravelly loams being derived from the underlying Carboniferous sandstones and conglomerates,—all of which are overspread with a dwarfish growth of post oak, Spanish oak, mesquite, elm, and hackberry. A portion of the fall was analyzed by Booth, Garrett, and Blair, of Philadelphia, for the Foote Mineral Company, in 1915. The composition of the meteorite is as follows: silicon, 0.004; sulphur, 0.172; phosphorus, 0.169; nickel, 6.670; cobalt, 0.560; copper, 0.014; carbon, 0.163; iron, 90.028; and iron oxide, 2.230. The specific gravity is 7.718.

One piece was used for the determination of troilite and schreibersite. The amount of sulphur is so small that the presence of troilite is doubted. Material resembling schreibersite to the amount of 9.343 per cent. was obtained, that is, 1.1175 grams of material insoluble in dilute hydrochloric acid was obtained from 11.96 grams of the original iron. This by analysis gave: iron, 68.594; phosphorus, 2.350; nickel, 4.920; cobalt, 0.180; and iron oxide, 24.000. This composition does not conform to that of schreibersite, and must represent some other phosphide.

MR. GEORGE K. CHERRIE, who left New York for South America in May, 1916, has returned after ten months spent in the swamps and forests of Paraguay and Brazil. During these months he continued the explorations begun by the Roosevelt-Rondon Expedition, which explored the "River of Doubt" in 1914, but which was unable to remain to investigate closely the life histories of the remarkable birds and mammals of the region. The most serious work of the new expedition began at Puerto Pinasco

in the Paraguayan *chaco*. Here about two months were spent in making collections. Three months were spent in field work in the Panateles, vast alluvial plains, entirely submerged during the rainy season, and the home of many species of water birds. As a result of the work Mr. Cherrie brings to the American Museum a collection of three thousand bird skins and four hundred skins of mammals, together with fifteen hundred photographs and a wealth of valuable data.

FOR several years about one hundred and fifty textile pupils and students of design a month have been making use of the Museum collection of ancient Peruvian textiles and pottery vessels. This number has been doubled of late since trade has discovered the value and fine state of preservation of the Museum collection. For the benefit of commercial workers in textiles, who have felt the dearth in design due to the cutting off of new ideas from abroad by the European war, the department of anthropology of the American Museum offered in February a series of lectures, illustrated by lantern slides of objects in the Museum, on primitive decorative design in the New World. The subjects discussed were: February 5, "Indian Pottery and Decorative Art," February 19, "Costume and Costume Decoration," both by Dr. Herbert J. Spinden, and February 26, "Primitive American Textiles," by Mr. M. D. C. Crawford. These lectures supplement an earlier series on primitive textile art in ancient and modern times, given at the Museum by the department of anthropology during October, 1916. There has recently been installed on the main floor of the Museum, through the courtesy of several silk manufacturing companies, an exhibit of silk fabrics and ribbons with designs inspired by the Museum's Mexican, Peruvian, and Amur River collections. The exhibit represents only a fraction of what has already been accomplished in design through the study of Indian art. Not only have the silk designers been busy, but cotton fabric and costume designers are becoming interested, and fabrics lately sent over from Paris show that the new note in American textile art may be expected to produce results in Europe after the war. The number of pieces of ancient American textiles in the Museum available for use of designers and others has been very largely increased by the donations of Mr. A. D. Juilliard. One of his gifts, a beautiful shawl-like garment found in a prehistoric grave near Ica, Peru, has recently been put on exhibition at the head of the stairway on the third floor of the Museum.

THERE is on view in the west assembly hall of the American Museum an interesting exhibit of paintings by William de la Montagne Cary, showing the West as it appeared during the years 1861 to 1874. The pictures, with their abundance of detail and local flavor, give intimate glimpses of Indians, traders, and settlers, of wolf packs and buffalo herds, the vanished features of a wonderland of life and adventure long since swept away by the westward spread of population.

THE American Museum expedition to Nicaragua for collections of reptiles and fishes has returned from the field. The expedition left New York on May 31, 1916, for Bluefields on the eastern coast of Nicaragua, going via New Orleans. Two weeks were spent collecting at Maselina Creek near Bluefields. On July 1 a trip was started up the Rio Grande and one of its tributaries, Sixicuas Creek. In August the expedition moved to the coastal belt and collected near Pearl Lagoon, midway between Bluefields and the mouth of the Rio Grande. In September the members of the expedition parted,—Mr. L. Alfred Mannhardt to operate near the mining regions of the north, Mr. Clarence R. Halter to go southward and to the west coast. Mr. Mannhardt sailed for the mouth of the Prinzapolka River, up which he proceeded one hundred miles, exploring the Yoyo and Pia creeks as far as the dugout pitpans could be poled. On the first of November an overland trip was begun, the equipment being forwarded by Indian pack carriers to the town of Tunky at the junction of the Tunky and Banbana rivers. In order to find a favorable field for collecting, a scouting trip was undertaken through Siuna and San Pedro, ending at Eden Mine in the heart of the gold district. Mr. Halter, in charge of the other division, went south to Barra del Colorado, Costa Rica, and up the San Juan River, collecting at La Hunter, Machuca, El Castillo, and San Carlos on Lake Nicaragua. Thence he continued up the lake to San Miguelito. Collections and studies were made along Tule Creek to its source; then followed an overland excursion in a northeasterly direction in the Chontales Moun-

tains. Steps were retraced to San Miguelito and work was carried on in this vicinity and on the island of Boquete. A trip was made to Managua, the capital, situated on the lake of the same name, stops being made along the way at Morito on the eastern coast of Lake Nicaragua, at Moyagalpa on Ometepe Island, at Rivas on the western coast, and at Granada. The collectors brought back more than fifteen hundred fish taken from many sections of the country, twenty-three hundred herpetological specimens comprising more than a hundred species, and two hundred and fifty photographs of the species and their habitats.

THE spring schedule of popular lectures at the American Museum of Natural History is as follows: on Thursday evenings the members' course of four lectures—March 8, "In the Jungles of British Guiana," by C. William Beebe; March 15, "In the High Sierras with John Muir," by Herbert W. Gleason; March 22, "Our Debt to Ancient American Civilizations," by Herbert J. Spinden; and March 29, "With Camera and Gun through Western Colombia," by Leo E. Miller; on Saturday mornings a series of stories for the children of members—March 3, "Among the Penguins of South Georgia," by Robert Cushman Murphy; March 10, "In the Land of Hiawatha," by Ann E. Thomas; March 17, "Wild Flowers of Spring," by G. Clyde Fisher; and March 24, "At Home in the Zoo," by E. R. Sanborn. There are also offered four courses of six lectures each, open to school children: on Mondays—March 12, "Our Waterways and their Protection," by George H. Sherwood; March 19, "A Journey in Western Europe," by Charles H. Rogers; March 26, "Through the African Jungle," by James P. Chapin; April 9, "Mexico and Central America," by Charles H. Rogers; April 16, "Our Newest Possessions—The Danish West Indies," by G. Clyde Fisher; and April 23, "Travels in South America," by Howarth S. Boyle; on Wednesdays—March 14, "The Explorers of Eastern North America," by Ann E. Thomas; March 21, "Early History of New York," by Roy W. Miner; March 28, "Lake Champlain, Lake George and the Hudson," and April 11, "Colonial and Revolutionary New England," by Ann E. Thomas; April 18, "The Growth of New York City," by Roy W. Miner; and April 25, "The Song of Hiawatha," by Ann E. Thomas; on Fridays —March 16, "The Conservation of Our Forests," by G. Clyde Fisher; March 23, "The History of Our Country's Transportation," by Ann E. Thomas; March 30, "Agriculture in the United States," by G. Clyde Fisher; April 13, "The City's Fire Department," by Fred H. Smyth; April 20, "Governing New York City," by Ann E. Thomas; April 27, "The Story of a Piece of Coal," by G. Clyde Fisher; on Tuesdays and Fridays—May 1, "The Story of the Winds," by George H. Sherwood; May 4, "Wild Birds of New York City," by S. H. Chubb; May 8, "Wild Animals near Home," by G. Clyde Fisher; May 11, "The Three F's—Fingers, Food, and Flies," by T. G. Hull; May 15, "How Life Begins," by G. Clyde Fisher; and May 18, "The Wonderful Work of Water," by George H. Sherwood.

FROM a preliminary survey of the lizards in the reptile collections brought back by the American Museum Congo Expedition, it appears that the 1435 specimens represent about forty species, several of which are new to science. The collection affords large series of many forms, especially of the skinks (Scincidæ), which will be of value in defining species hitherto known from relatively few specimens. As would be expected from the tropical forest habitat, the snakes, with 805 specimens, greatly outnumber the lizards in species, about seventy (several of these also new) being represented. In the course of the study of the Congo species a reëxamination of Dr. Hallowell's West African types at the Academy of Sciences of Philadelphia is being made; also the Richard Douglas collection from Matabeleland, belonging to the American Museum, will be reported on in the same connection.

AT the time of his death, July 6, 1914, Dr. Seth E. Meek of the Field Museum of Natural History, Chicago, was engaged in the preparation of an exhaustive catalogue of the fishes of the fresh waters of Panama. This work has recently been brought to a successful conclusion by S. F. Hildebrand of the United States Bureau of Fisheries and published by the Field Museum. Such an addition to the knowledge of the fauna of Panama, the present connection between North and South America, is of importance to the science of zoögeography, in which Dr. Meek was interested. The present work contains plates of many interesting neotropical catfish, Characins, Gymnotids, and of a new genus of goby.